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Report of the
THIRTEENTH SOUTHERN PASTURE AND FORAGE CROP
IMPROVEMENT CONFERENCE^{1/}

Georgia Experiment Station
Experiment, Georgia

May 15 - 17, 1956

Tuesday, May 15, 1956

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^{1/} Reported by W. A. Hardison, Va.; W. B. Anthony, Ala.; N. L. Taylor, Ky.; P. B. Gibson, S. Car.; and H. D. Gross, N. Car.; and compiled by P. R. Henson, Permanent Secretary, U. S. Department of Agriculture, Agricultural Research Service, Beltsville, Md.

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Thursday Morning, May 17

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May 15, 1956 - 9:00 A.M. The opening session was called to order by the Chairman, Dr. R. E. Blaser, of the Virginia Agricultural Experiment Station. Dr. Otto E. Sell introduced the speakers for this opening session. In the absence of Dr. F. F. Cowart, Resident Director, because of illness, Dr. S. V. Stacy, Head of Agronomy, welcomed the conferees to the Georgia Agricultural Experiment Station. Dr. Stacy pointed out that there are twelve departments and ninety staff members on the experiment station staff at Experiment, Georgia.

9:10 A.M. The Pasture and Forage Research Program in Georgia,

✓ G. H. King, Director of Experiment Stations.

Director King reported on the expanding agricultural research program of the state. Beginning in 1950, four new experiment stations and four field stations have been developed in the state. These research centers are so located that not only are the major soil types covered, but major types of farming areas are also included.

The forage program of the state is carried on by 21 full time professional men, all working in a coordinated program with research men in related fields. The accomplishments of research include in part the development of such improved varieties as Dixie Reseeding crimson clover, fine turf, Coastal Bermuda grass, Starr millet, Tift Sudan, and others. Studies of the value of sod-based rotations, diseases and insects of forage crops, nitrogen requirements of Coastal Bermuda with (1) limited and (2) unlimited acreage, and others constitute fields of work where significant progress is being made. Much of the work is in cooperation with the U. S. Department of Agriculture.

Director King stated further that the Georgia research workers have the tremendous responsibility of producing livestock products at still lower costs. He cited the progress made in broiler production. Broilers at 9 weeks may weigh 3.8 pounds and can show a profit when sold for 20 cents per pound, where only a few years ago 30 cents per pound was needed for a profit. Similar efficiency must be developed in hogs, dairy, and beef cattle. We must avoid the situation now existing in cotton, where production in the United States will be the lowest on record while world production may be much higher.

9:25 A.M. Introduction of Members and Visitors. Chairman Blaser asked that the members, by states, stand and introduce themselves. The members in attendance from each state in this opening session were as follows:

Alabama	3	Kentucky	3
Arkansas	2	Mississippi	3
Florida	5	Puerto Rico	2
Georgia	23	Tennessee	1
Louisiana	3	Texas	5
Oklahoma	4	Beltsville, Md.	6
North Carolina	9	Fertilizer firms	5
South "	4	Virginia	4
		Total	82

Announcements: The locations of the sectional meetings were announced. Arrangements for the lunches were completed and also for the banquet the following evening at 7:30 P.M.

The morning tour covered the small grain variety forage study being conducted by Dr. U. R. Gore. Dr. Craigmiles explained the techniques involved in a study of Ladino and white clover, irrigated and non-irrigated, alone and with fescue, Coastal Bermuda, and Dallis grass. According to the results, Ladino was superior to other clovers. The costs, construction and operation of experimental silos was discussed by Marshall McCullough. Complete information can be obtained on any silage used in these silos.

Tuesday, May 15

1:30 P.M. Field Tour of Forage Research in Departments of Agronomy, Animal Husbandry, and Plant Introduction.

A most interesting tour was taken by the conferees. The overall forage program under way at the experiment station covered variety testing of forage legumes and grasses, breeding work with tall fescue, white clover, sericea lespedeza, and brome grass; establishment studies, sod crops in rotations, forage evaluation with animals, winter grazing systems, temporary and permanent pastures measured in terms of animal gains by beef cattle, sheep, or hogs, or of milk production with dairy cattle. Discussions led by Drs. O. E. Sell, J. P. Craigmiles, D. M. Baird, M. E. McCullough and others on the Station staff cleared up questions on the way experiments were conducted and on the results obtained.

Wednesday, May 16

Section I. Forage Evaluation. First Session

W. B. Anthony, Ala., Chairman

W. A. Hardison, Va., Section Secretary

8:00 A.M. The program of the session proceeded as follows:

× Some Methods of Handling Slaughter Cattle to Maximize the Usefulness of Grazing Crops and Economy of Beef Production, R. C. Carter, Va.

The problem of maximization of utilization of grazing crops by beef cattle stems largely from the seasoned imbalance of forage production, both in quantity and quality from improved as well as native pastures. A large quantity of highly nutritive forage is usually available in spring and early summer followed by a decline in both quality and quantity in midsummer and, depending on the season and pasture species, a possible recovery in early fall months. Maximization of the economy of beef production in most of the Southeast involves the production of carcasses of desirable quality (good to low choice), at weights in general demand (1000 to 1100 pounds or less for steers and 750 to 900 pounds for heifers) with a maximum utilization of pasture and roughage and a minimum of grain.

Some systems which may be useful in maximizing the economy of beef production from pastures in the bluegrass area of the Upper South are as follows:

1. Seed part of present crop land to highly productive grass-legume mixtures as supplement to permanent pastures. Stock permanent pastures at optimum rate to utilize early spring growth. Harvest the first cutting of the grass-legume mixtures for silage as hay and use as supplemental pasture during midsummer months.

2. Supplemental annual crops such as sudan grass, millets or other crops may be used as midsummer pastures permitting heavier initial stocking of permanent pastures.

3. Supplemental grain feeding on pasture from midsummer to end of grazing season may enable slaughter cattle of acceptable finish to be produced from yearling steers. The grain feeding is likely to reduce roughage consumption at the time the growth of forage is lowest.

4. Use heifers as part of the grazing animals. Heifers mature and fatten earlier than steers and thus may be ready for market by midsummer when the supply of forage is in decline. Heifers are usually as well finished by midsummer as steers in October. Heavy heifer calves wintered to make good gains and fed supplemental grain on pasture should reach desirable/slaughter weights and grades by midsummer. Light weight yearling heifers wintered to make $3/4$ to one pound gain per day will reach desirable slaughter grades at not too heavy weight on good pasture without grain supplementation by midsummer.

5. Sheep are an ideal animal to supplement beef cattle in utilization of early surplus forage. Lambs on good pasture will be finished and ready for market by midsummer. Dry ewes may and should be run on sparse pasture prior to breeding season, permitting use of best pastures by beef cattle in midsummer.

Discussion

Sell(Ga.): How can we use differences in the finish grade of cattle in our pasture evaluation work?

Carter(Va.): We need a standard whereby gain, previous treatment, and end quality are all reported in short term pasture results.

Sell: What about the use of antipyrine as a body composition measure?

Engel(Va.): Cornell work indicates that it is a reliable method in steer work.

Kincaid(Tenn.): Suggest that the group set up relative values for feeder cattle in terms of grade when pasture evaluation begins and ends. It might be an index number system.

Neathery(Ga.): Reported on use of antipyrine, stating he found no relationship between age and body water from 4 months of age.

W. E. C. Moore, Va.

Present methods for the study of rumen function include washed cell techniques and in vitro incubation of rumen materials which have an advantage of controlled conditions but are carried out in an abnormal environment on samples of material that were left in the rumen after parts of the material had been selectively removed. In in vivo measurements utilizing fistulas, stomach-pump, or slaughter samples, control is sacrificed. Materials are lost from the rumen at unknown rates. Available data indicate that pH, competitive substrate, temperature, location and apparently several other unmeasured variables affect the rate of cellulose digestion. Each of these seems to be related to the rate of removal of end products from the rumen. Volatile fatty acids, for example, can apparently be produced faster than they can be absorbed, thus lowering pH and decreasing the rate of digestion in the animal.

Discussion:

Belasco(Del.): In view of colon and caecum fermentation, what is the validity of digestibility results?

Moore(Va.): Fermentation must be considered and further work is needed to evaluate to what extent absorption from colon and caecum takes place.

✓ Forage Utilization by Ruminants - Microbiological Advances, ✓
K. W. King, Va.

Beneficial functions of the rumen microflora include B-vitamin synthesis, sulfate assimilation, crude fiber digestion, improvement of protein quality, detoxification, and decontamination. Detrimental processes include energy loss, abnormal toxic fermentations, and depression of the nutritive value of high quality proteins.

Current information on the number and kinds of bacteria and protozoa in the rumen are considered, particularly with reference to the bacteria, since little information on the protozoa is available.

The rumen fermentation of protein is very rapid and leads to production of ammonia and volatile acids including the C₄ and C₅ acids known to be essential nutrients for the cellulolytic rumen bacterium Bacteroides succinogenes. A second interaction between protein and cellulose fermentation consists of a sparing action of amino acids on cellulose utilization. This latter phenomenon has been demonstrated with soil organisms, but the investigations have not yet been extended to rumen bacteria.

Carbohydrate fermentation results in acetate, propionate, and butyrate production. Immediately after feeding, excess sugars are stored as intracellular polysaccharides by rumen bacteria and protozoa for later use as energy sources when the free sugar concentration in the ingesta has fallen to the normal low values.

The mechanism of enzymatic cellulose decomposition by soil bacteria via random cleavage is reviewed. Problems surrounding the enzymatic hydrolysis of cellulose in the rumen are discussed, including the stability, origin, multiplicity, and extraction of the rumen cellulose.

Y The Artificial Rumen Technique as a Means of Evaluating the Nutritive Value of Forage Crops, I. J. Belasco, E. I. du Pont de Nemours & Company, Del.

The active development of various in vitro rumen techniques has stemmed from the need for a fuller understanding of rumen function as a prerequisite for further advances in ruminant nutrition. In spite of certain limitations, the artificial rumen techniques have been used to advantage for rapid, economical and quantitative evaluation of nutritional, biochemical and microbiological variables within the rumen. In vitro findings have given sound basis for accepted good feeding practices and will provide the basis for improved feeding practices of the future. The in vitro approach has been used successfully for the rapid evaluation of novel non-protein nitrogen compounds, trace mineral relationships, the role of carbohydrates, the production of the metabolically important volatile fatty acids, and the importance of roughage quality. It is believed that further development of artificial rumen techniques will permit accurate monitoring of forage and roughage quality in the overall objective of more efficient and economical beef and milk production.

Discussion:

Engel(Va.): If in vitro techniques demonstrate 20-60% better cellulose digestion with urea than with an equal amount of soybean meal, why don't animals respond in the same fashion and exhibit more efficient gains on urea feeds?

yet

Belasco(Del.): We may not/know how to intelligently supplement urea under feed conditions.

Sell(Ga.): Anthony(Ala.): If we had no cellulose in forages, could we evaluate them?

Belasco: Protein synthesis could also be used as an index in in vitro studies.

Blaser(Va.): Are there any real correlations between in vitro techniques and animal performance?

Belasco: So far, correlations are only qualitative.

Gullison(Ga.): There is lower cellulose digestion in wheat straw than in pure cellulose. Why?

Belasco: This could be due to lignin in wheat straw.

Engel: Can end product accumulation seriously influence in vitro results?

Belasco: Yes.

King(Va.): Should the animal be adjusted to the ration that is used for source of in vitro organisms source to minimize former ration effects?

Belasco: Yes.

Neathery(Ga.): Should you consider the energy requirement that must be supplemented with urea?

Belasco: This is of greatest importance.

Sell: It is very desirable that in vitro techniques be correlated with digestion trial data.

Cullison: When you compared urea and protein, did you compare mixtures of these?

Belasco: Yes.

Sell: In Georgia studies, the chromogen content of fescue strains was correlated with digestibility.

King: How would rabbits serve as test animals compared with in vitro artificial rumen?

Belasco: Rabbits are not ruminants.

Kincaid(Tenn.): Is high quality forage a concentrate rather than a roughage?

Moore(Va.): In vivo and in vitro techniques for cellulose digestion do not correlate well.

Blaser: Protein used as an indicator of quantity within species may be satisfactory.

✓ Numbers of Samples for Determination of Laboratory Measures of Forage Quality, E. F. Schultz, Jr., Ala.

Components of variance affecting estimates of forage consumption by steers as determined by the chromic oxide-chromogen technique are given in Table 1, together with the general mean of the experiment. The components represent the three sampling levels, paddocks, steers, and laboratory determinations. Also given are the components affecting the four separate laboratory measures of various qualities which must be used to determine the amount of forage consumed and the components affecting the intermediate characteristics which must be computed. The components are pooled estimates derived from analyzing the collections made in 6 grazing periods in each of 2 years from the steers in the species-nitrogen grazing experiment at the Wiregrass substation, Headland, Ala.

The data concerning grams of dry matter consumed per day (line 1, Table 1) were used to compute the numbers of steers per paddock necessary to achieve several stated degrees of precision for varying numbers of paddock replications and varying numbers of laboratory determinations per steer. The results are shown graphically in Figure 1. It is thought that other investigators using the chromic oxide-chromogen technique may use these curves for estimating size of experiment (number of replications), number of samples (steers) per paddock, and number of subsamples (laboratory determinations) per sample. This is probably true if their animals and collection methods are not too different from the 7-day collection periods used with yearling steers in these studies. The method of using is to choose from the graph the cheapest experiment or sampling scheme which has the desired precision. This will necessitate estimating over-all costs of a number of schemes or plans.

A first generalization of the results comes from the note in Figure 1, " $\pm .05 \bar{x}$ requires > 21 replications". This means that to estimate the difference between two single treatments at any one grazing period within ± 5 per cent of the general mean would require more than 21 replications. Such an experiment would be prohibitive in cost.

A second generalization comes from observing graphs similar to Figure 1 for the other characteristics reported in Table 1. There is not much chance that the appropriate sampling scheme would involve larger pastures with large numbers of steers (over 5 to 10 per pasture) unless the cost of an additional steer is considerably less than an additional pasture. All curves are directed nearly straight upward at all points above 5 to 10 steers per pasture.

The most important generality is that neither the increase in precision due to running laboratory determinations in duplicate rather than singly nor the decrease in precision that would result from compositing by pairs of steers on a paddock before running a single laboratory determination is sizeable; note how small σ^2_3 is compared to the sum of the other 2 components, line 1, Table 1. Since the cost of laboratory determinations is relatively high, it is thus possible to effect a sizeable reduction in cost without a correspondingly large reduction in precision merely by dropping the time honored custom of running laboratory determinations in duplicate or, perhaps, pushing the process one step further by compositing together the samples from two steers on the same pasture before making single laboratory determinations on these composites. Savings from the above mentioned procedures could be used either to sample more steers or obtain more samples per steer.

To check the foregoing generality by another method, it is noted that there is a cost ratio, cost of sampling steers to cost of running laboratory determinations below which it would be economical to composite the samples from steers together before laboratory analysis. Solving for the particular results obtained in this study reveals that if the ratio is less than 1:1 (roughly), then compositing of the samples from two steers is advisable; hence, if in actual practice it costs less to obtain a sample from another steer than it does to make the 4 different laboratory determinations required from each sample, then the optimum scheme would be to composite the samples from pairs of steers together before laboratory determinations.

Table 1. Variance components (1) affecting estimates of grams of dry matter consumed daily and the several laboratory determined measures from which computed

Character	σ^2 : 1 due to : experimental : units, paddocks:	σ^2 : 2 due to : sampling : units, paddocks:	σ^2 : 3 due to : subsampling : units, steers:	General det'n: mean
DM consumed per day, gm.	304,138	712,853	149,217	6,536
Fecal DM excreted per day, gm.	50,426	117,215	24,548	2,721
Indigestibility coefficient	.000,043,76	.000,239,66	.000,059,37	.4183
Cr $\frac{O}{2}$ per gm. fecal DM, mg.	.1268	.2072	.0329	3.61
Chromogen per gm. fecal DM, mg.	190	1562	478	295
Cr $\frac{O}{2}$ per gm. air dry feces, mg.	.1416	.1702	.0275	3.306
Oven, DM, per cent	.5056	.3946	.2690	91.62
Chromogen per gm. wet feces, mg.	10.35	25.75	—	34.52
Toluene, DM, per cent	.268	1.822	.590	12.18

(1) Obtained by pooling results for 6 periods in each of 2 years.

Section II. Forage Crop Breeding, First Session

C. H. Hanson, N. C., Chairman

N. L. Taylor, Ky, Section Secretary

8:00 A.M. ^V A Radiation Service for Southern Plant Breeders, [<]
T. S. Osborne, Tenn.

The University of Tennessee, under contract with the U. S. Atomic Energy Commission, operates the "UT - AEC Agricultural Research Program" in Oak Ridge. This program has for some 8 years been devoted to peaceful uses of the atom, in agricultural research, chiefly in studies of animal nutrition. Recently, a project dealing with radiation effects on plants has been added. The primary goals of this project are (1) to furnish radiation sources, and people trained in their use, to plant breeders in the southern experiment stations, and (2) to conduct research leading to more effective uses of radiation in plant genetics.

1. Possible uses of radiation in plant breeding.

Plant breeders in several parts of the world have reported desirable mutants appearing in agricultural plants following exposure to radiations. Mutants for stiff straw, earliness, disease resistance, yield, and altered chemical composition have been reported. Alterations in size, shape and color of leaf and flower make excellent "markers" for genetic studies and determination of isolation distances. Genetic variability is the raw material of the plant breeders, and studies of Gregory and others have shown that ionizing radiations induce genetic and chromosomal variability even in progeny of plants not visibly affected.

It may sound foolish to say that radiation cannot do the impossible, but the point is that no changes can be induced that Nature would not cause eventually, given infinite time. Radiation increases their frequency of occurrence and their probability of appearing within the life span of the breeder.

At present, it appears that X-ray and gamma rays produce more "point mutations" than chromosome rearrangements, while neutrons cause more gross rearrangements and less cytoplasmic damage. It may be, in fact, that all so-called gene mutations involve multi-genic rearrangements, though perhaps sub-microscopic in size. At our present state of knowledge, it seems wise to split all samples between gamma and neutron treatments, where possible.

2. Difficulties of the method.

Perhaps the greatest drawback to radiation breeding derives from the fact that induced mutations, at least in diploids, are recessively inherited. This, of course, means that changes will not be visible in the treated generation (outside of temporary, toxic effects), and all the seed must be harvested and grown out for at least one more generation. Given reasonably fertile plants, a few treated seeds thus soon become the cause of rather large expenses in land and labor.

Another difficulty is that of perceiving the mutants. If one is looking for items such as yield or composition, a second-generation population of 1/2 acre or more represents a great number of tedious measurements. Where large numbers can be tested with relative ease, such as with disease epiphytotics, the method is quite feasible and may have its greatest merit.

Quite a few plant breeders would like to use radiation in their programs, but often it is difficult for them to obtain treatments. The University of Tennessee has been able, through its contract with the Atomic Energy Commission, to provide such a service free of charge to the southern land-grant colleges. There follows a brief description of the facilities and the way to obtain use of them.

3. Facilities.

There are three suitable sources of radiation, two of gamma rays and one of neutrons.

a. High-intensity gamma rays. Mainly for seeds, the sample container is $1\frac{1}{2}$ inches I.D. and 10 inches long. For exposure, a cylindrical cobalt-60 source is raised from a well to surround the sample, and lowered when the desired dose has accumulated. Strength is 100 curies, and a dose of 10,000 r is given in a few minutes. Larger material, such as roots or tubers, is placed in a circle of 2-ft. radius outside the sample position, and the source raised as before. After half the desired dose has been given, the material is rotated 180° to expose the "off" surface.

b. Low-intensity gamma rays. This so-called "donkey field" has 18 individual sources arranged to provide a uniform flux of about 30 r/hr over some 250 square feet. Plants grown in containers can be moved into the field to receive a few hundred r at a critical time, such as pre- or post-meiosis.

c. Reactor-produced neutrons. Access to the Oak Ridge graphite reactor is obtained via a lead-lined tunnel and cart, the latter being about 17 by 8 inches by 5 inches high (inside). The bottom of the cart is loaded with natural uranium, topped by several inches of lead. The uranium captures a large portion of slow neutrons, "converting" them into fast neutrons by fission. The sample area thus receives a mixture of fast and slow neutrons, with most of the gamma-ray contamination removed. Seeds, budsticks, tubers, and so on, up to the dimensions stated, can be treated.

d. Laboratory and growing areas. A laboratory has been equipped for cytological and germination studies, and field and greenhouse facilities are being devised.

4. Methods for receiving service.

Each of the Southern States has been contacted and has named a person to act as co-ordinator for the state in this program. It is his duty to distribute information to those who might be interested, keep them supplied with application forms, and prod them into filling out the report form which we return with the treated material, so that our service will improve.

The coordinator talks them out of sending a million seeds for treatment if a few hundred will increase to a million by the critical (second) generation, and out of sending whole fruit trees if a few buds or pollen grains will suffice. He sees to it that samples are submitted a month or more ahead, so that seeds can be brought to moisture equilibrium and preliminary dose-response tests can be made, if necessary. He asserts that each sample is for non-profit research--our one stringent stipulation. The state representative, in short, is probably the most important member of this team.

If you want material irradiated, contact your state representative. If you don't know who he is, Mr. James of Experiment, has a list of them. Fill out the one-page application form, sign it, have the representative sign it, and send with the material to me at the address below, or to the UT-AEC Program, Box 142, Oak Ridge, Tennessee. If you know the kind of radiation and dosage you want, that is fine. If not, we will make the decisions. Thanks mainly to the generosity of people at Brookhaven, Nebraska, Minnesota and elsewhere, who have sent us unpublished data, we have an idea of the tolerance of a good many crops. It is only fair to add that we have received a number of exotic genera from Puerto Rico that have us completely stumped. Since there is quite a variation in tolerance even between strains of the same species, it is deemed unwise to give any sample a single dose only. Our customary practice is to split each one into 11 lots--5 for different doses of gamma rays, 5 for neutrons, and one for control.

We return the material to you with fervent hopes for success, and the rest is up to you. Good luck!
Address: T. S. Osborne, Agricultural Experiment Station, University of Tennessee, Knoxville, Tennessee.

9:00 A.M.⁺ Where do we Stand on Breeding for Improved Quality? Panel Discussion.* G. W. Burton, Ga., Leader.

Dr. Burton opened the panel discussion by calling on members of the panel for their opinion on the problem of breeding for improved quality. The remarks of the panel are summarized as follows:

W. A. Hardison, Virginia - It is true that the plant breeder should know precisely what the livestockman wants before he undertakes an extensive breeding program designed to produce forage species of high quality. At the same time the animal man is in the unfortunate position of not being able to adequately define forage quality, and thus, cannot tell the plant breeder what qualities should be incorporated and which should be deleted in the breeding of forage species.

Livestockmen in general would agree that those plants which are high in protein, low in crude fiber, containing a high proportion of leaves and readily consumed by animals are high in quality. In the final analysis, however, it is animal performance which determines forage quality and it is not inconceivable that a forage could possess all of these characteristics and still be inadequate in terms of producing milk, growth and meat or in maintaining normal reproductive function. Still, in some areas of the country the ability of a plant to grow and produce herbage constitutes quality in that particular plant.

Since it has been known for many years that stage of growth is one of the most important factors affecting the chemical composition of plants, and thus, presumably forage quality, more progress may be made if the plant breeder devotes his time to the development of high-yielding strains and more emphasis is placed on management practices which are considered to favorably affect forage quality. The development of plants which are resistant to diseases and insects would appear to be an important contribution of the plant breeder.

Much of the unfavorable animal response which is frequently attributed to low or poor quality forage may actually be due to the animal itself. Until it is known just what part the animal does play in such situations and until it is known just what constitutes quality in forage plants, it is impossible for the animal man to intelligently advise the plant breeder as to what his needs relative to forage quality really are.

E. D. Donnelly and G. E. Hawkins, Alabama - In 1952 results of a "cafeteria" style grazing study at the Agricultural Experiment Station of the Alabama Polytechnic Institute indicated that stem type and tannin content affect palatability of sericea. Since that time very uniform fine-stemmed inbred lines having good agronomic characteristics have been developed. Also, low tannin lines have been developed, but these do not have the agronomic characteristics desired.

About 40 fine-stemmed sericea lines have been studied in some detail in the laboratory, using rabbits and chemical analyses. A number of fine- and of coarse-stemmed lines were composited and fed separately to rabbits. The dry matter of the fine-stemmed diet was approximately 10% more digestible than that of the coarse-stemmed diet, and the consumption of the former was approximately 10% greater than that of the latter. Since there was a considerable range in the material put into the fine-stemmed diet, it is felt that the above differences would have been greater if sufficient forage of one of the better fine-stemmed lines had been available for feeding as a separate diet.

In vitro studies with pepsin indicated that the digestibility of sericea protein was negatively correlated with percentage of tannin in leaves of above inbred lines, i.e., the sericea-leaf protein decreased in digestibility as the tannin increased.

Two of the above inbred lines were higher in the following respects than the others studied: digestibility of dry matter, digestibility of protein and per cent of crude protein, and were lower in percentage of cellulose, percentage of crude fiber and of lignin. Several inbreds growing at two locations were studied. The line that contained the highest level of crude protein in 1954 averaged the highest for two cuttings in 1955. This inbred was consistently higher in crude protein than commercial sericea when grown in the same test. A number of the above inbred lines have been put into experimental synthetic and hybrid varieties and are also being increased as inbreds for possible use as pure line varieties.

E. C. Holt, Texas - Texas has no breeding program in which improved forage quality is the primary objective. We are in an area where yield or quantity, persistence and drouth tolerance are of major importance. We are interested in the techniques that are being used to measure quality. A fairly simple and rapid technique must be available if it is to be used early in the breeding program.

J. R. Harlan, Oklahoma - Some ten years' work on the problem of breeding for improved quality in Oklahoma has led to the following somewhat tentative conclusions.

1. Analyzing individual plants in a population for protein content in order to select for protein production is too cumbersome and expensive to be of much help.
2. Protein content of individual plants has a low repeatability when the plant is sampled several times and significant differences are hard to demonstrate.
3. In sand bluestem real differences in leafiness exist although heritabilities are low. Considerable progress has been made in selecting for leafiness in this grass.
4. Chemical analyses of clones selected for agronomic characteristics and good general combining ability are very useful in contrast to analyses of plants in a source population.
5. Significant differences in leafiness, protein and phosphorus content have been shown for such clones.
6. In weeping lovegrass, good correlations between tenderness as determined by a simple pull test and acceptance by livestock have been obtained.
7. Both nutritive value and palatability are often influenced much more by management than by the intrinsic qualities of the species or variety.
8. Breeding for improved quality is difficult but possible. Probably the simplest method is to breed for increased leafiness.

M. E. McCullough, Georgia - Basically the dairyman wants a forage that will supply his animals with the required nutrients for the production he desires. Forages could be divided into two classes - (1) fill-belly forage and (2) concentrate - sparing forage. In modern livestock feeding there would be little need for the first type. In dairying there is almost no period in the life of a dairy animal when only maintenance is desired. If a forage is to replace or spare concentrates, then the forage must closely parallel grain in composition, digestibility and nutritive value. In addition to these unit characteristics, the forage must permit a level of intake which will provide an adequate nutrient supply.

The plant breeder must supply forages with the genetic capabilities of permitting the production of desired quantities of "grain-like" forage under existing soil and climatic conditions. He should see the dairy feeding program as a unit, and provide forages to meet the specific feeding requirement of each period.

In the dairy program at the Georgia Experiment Station, the aim is to provide a forage meeting the following specifications:

- (1) Dry matter digestibility - 70% or more.
- (2) Crude protein - 16-20%
- (3) Crude fiber - 20-25%
- (4) Intake - 3.5 pounds of dry matter per 100 pounds body weight.

E. N. Fergus, Ky. - Breeding Tall Fescue for Palatability - Two breeding procedures are being followed at the Kentucky Station to improve the palatability of tall fescue. One is selection within the species. The possible effectiveness of this procedure was indicated by a study initiated in 1950. About 2000 spaced plants were grazed repeatedly during that year. Although animal selection varied considerably with the season, some plants were consistently well grazed at all grazing periods. Consequently, a program was outlined whereby the progeny of the best grazed plants in the source nursery would be studied to determine if palatability of tall fescue was a heritable characteristic.

Two methods of selection were studied simultaneously. One allowed only the best grazed plants to cross-pollinate and produce seed for the succeeding generation. The second method consisted of selfing the best grazed plants and using the seed to establish succeeding generations. Three generations of selection have been studied. Progress seems to have been made by both methods of breeding as indicated by grazing results on second and third generation inbred and open-pollinated material; however, greater progress seems to have been made by the inbred line method of breeding than by the maternal line method.

Maternal and inbred line selections are being further evaluated in polycross tests and as synthetics. One highly palatable 3rd-generation inbred line is approximately as vigorous as the Ky 31 variety. This inbred line and a synthetic of eight 3rd-generation inbred lines crossed in isolation were established in sod plots in August, 1954, along with 3 naturalized varieties, and Ky 31, Alta and Goar fescue. The plots were grazed in October 1955. Both the inbred line and the synthetic were significantly better grazed than the varieties in the test.

A second cycle of selection was started in September, 1954. Spaced plants were established in a nursery from seed of four 3rd-generation inbred lines crossed in isolation with Ky 31 and from seed of a synthetic of 8 3rd-generation inbred lines crossed in isolation. Plants of the Ky 31 variety were established in the nursery as a check. The nursery was grazed twice during October, 1955. All inbred lines crossed in isolation with Ky.31 and the synthetic strains were significantly better grazed than Ky. 31. The synthetic strain was significantly better grazed than the inbred lines crossed with Ky. 31.

The second breeding procedure consists of hybridizing tall fescue with perennial ryegrass and annual ryegrass. Sterile hybrids resulted. Treating these with colchicine has not been helpful but backcrossing with tall fescue has secured increasing fertility in successive generations. Grazing of these hybrid progenies indicates much variation in palatability. Some lines appear to be highly palatable in comparison with the Ky. 31 variety of tall fescue.

The spotted alfalfa aphid (Pterocallicidium sp.), probably represents one of the most serious hazards ever to confront the alfalfa growers of the United States. This pest was first reported to be doing economic damage to alfalfa in this country early in 1954. During the two years since the initial outbreak was discovered in the Pecos Valley of New Mexico, the spread of this insect has been extended from the West Coast eastward to the Mississippi River, and from the Mexican border northward to a west-east line extending approximately from northern California to northern Nebraska. In 1956, specimens of the spotted alfalfa aphid were collected from alfalfa at Gainesville, Florida. There is thus far no evidence that climatic, geographic or other barriers will prevent this pest from becoming a problem of alfalfa throughout the continental United States.

Entomologists tell us that reproduction of the spotted alfalfa aphid is by parthenogenesis. Population build-ups approach the phenomenal, particularly during spring. Contrasted with the pea aphid which feeds on the terminal portions of alfalfa stems, the spotted alfalfa aphid prefers to feed on lower parts of the plant that are partly or completely shaded. Counts in heavily infested fields have shown up to several hundred aphids feeding on a single stem. Plants injured by aphids drop large portions of their leaves and show a decided loss of vigor, with a concurrent serious reduction in level of yield and a subsequent loss of stand.

The spotted alfalfa aphid is a copious producer of honey dew on which a mold oftentimes develops. In many instances honey dew becomes so heavy on the plants that it interferes with harvesting by causing a gumming up of mower cutter bars, impairing the curing of the hay, and stopping the proper functioning of automatic tying mechanisms on alfalfa bailers.

Estimates of damage from this pest to the alfalfa crop for the calendar year 1956 are high. Insecticides have been reasonably effective for controlling the aphids when temperatures are 60° F. or above. However, since a high proportion of the aphids are winged forms and almost 100 percent are females, reinfestation and economically damaging population build-ups occur quite rapidly.

The Entomology Research Branch of the Agricultural Research Service, and several State Agricultural Experiment Stations are searching in this country, as well as in Iraq and adjoining areas of the ~~Western~~ ^{EASTERN} Hemisphere, for parasites and predators of the spotted alfalfa aphid. It is too early to know what success might be attained through biological control.

The variety Lahontan which was developed by the Field Crops Research Branch, ARS, U. S. Department of Agriculture in cooperation with the Nevada Agricultural Experiment Station, was jointly released by these agencies and the California Agricultural Experiment Station in 1954 for its resistance to stem nematode and bacterial wilt. Cooperative studies between entomologists and plant breeders have shown this variety also to have a relatively high level of resistance to the spotted alfalfa aphid. In fact, three of the five parent clones of Lahontan, namely, C84, C89, and C900 approach immunity to this pest. Testing of this variety for adaptation to the various regions where spotted alfalfa aphids are a problem is under way. Seed stocks are being increased as rapidly as possible so as to fulfill the needs of the variety.

Breeding for resistance to the spotted alfalfa aphid may be approached in several ways. Methods worthy of consideration include (1) appraisal of existing varieties of alfalfa to determine whether any have high enough levels of resistance to be of economic value; (2) recurrent selection involving resistant plants coming out of superior breeding stocks, or from heavily infested field plantings of varieties adapted to certain climatic regions; (3) hybridization to transfer resistance of known stocks into breeding materials that are otherwise superior for certain specific problem areas or regions; and (4) the backcross method, using for a given problem area the most productive and otherwise superior variety as the recurrent parent. Regardless of the method of breeding used, the plant breeder's primary concern at the moment is to get suitable levels of resistance as quickly as possible so as to meet the spotted alfalfa aphid problem. The slower and more refined breeding programs should prove successful in the development of high yielding varieties characterized by multiple disease and insect resistance.

In view of the continuing spread of the spotted alfalfa aphid, alfalfa breeders in all parts of the country should expand their testing programs so as to include all stocks which show promise of resistance to this pest. The cataloguing of materials for aphid reaction will facilitate inauguration of breeding programs as the aphid spreads into areas where it is not yet known. In some localities existing resistant varieties may prove adequate to meet farmer needs without any further breeding effort. It should be emphasized, however, that the variety Lahontan which is proving so valuable in portions of the spotted alfalfa aphid area of the Southwest, is highly susceptible to the leaf and stem diseases which plague alfalfa in the humid East. Thus, in those areas where foliar diseases are serious, Lahontan will probably serve only as a stop-gap variety until such time as more desirable spotted alfalfa aphid resistant varieties can be developed.

10:50 A.M. Uniform Grass Testing - A. A. Hanson, Beltsville, Md.

✓ Dr. Hanson reviewed the status of the cooperative grass testing program. The objectives of the program are as follows:

- (a) Provides opportunity for states to test new strains prior to release. This enables states to develop recommendations when a particular strain is released or when seed becomes available in sizeable quantities.
- (b) Provides information on regional adaptation and hence supporting data for recommending the release of new varieties.
- (c) Provides for the inclusion of a limited number of accessions or breeding materials in order to evaluate the significance of new breeding procedures and/or sources.

- (d) Provides a group of varieties that can be used to test the adaptation of a species to a specific environment.

Lists of varieties available for testing are distributed to cooperators together with an annual summary of the previous year's results. Entries in the testing program are revised on the basis of three-year summaries and suggestions received from cooperating stations. Cooperators can assist the program by submitting seed requests and reports as promptly as possible.

11:20 A.M. New Breeding Programs Underway - P. B. Gibson and L. W. Baxter, S. Car.; W. A. Cope, N. Car.; H. D. Wells, Ga.

✓ White Clover Improvement Project - P. B. Gibson & L. W. Baxter, S. C.

This project was started in the fall of 1955. It is a cooperative project sponsored by the Field Crops Research Branch of the Agricultural Research Service and the South Carolina Agricultural Experiment Station. At present a geneticist, a pathologist and an agricultural aid are working on the project.

Available plant material from many sections of the world are being examined for superior germ plasm adapted to the growing conditions of the Southeast.

Determining the importance of the different factors that cause the loss of white clover stands is a major part of the work at Clemson. This phase of the project includes studies of the different diseases, nematodes, and environmental conditions.

Since the scope of the project is regional, we are making a special invitation for you to notify us of problems concerning white clover. The lines we have are available to any state conducting a breeding program.

X Inheritance of Rust Reaction in Alfalfa⁴ - W. A. Cope, N. Car.

The inheritance of rust reaction in alfalfa was studied in 3 crosses from 4 individual plants. The identification of these plants and their rust reaction was as follows: plant number 2, resistant; number 4, resistant; number 5, susceptible; and number 8, moderately susceptible. The crosses used were 4 x 5, 4 x 2, and 8 x 2. In each cross 8 generations were studied: parents 1 and 2 (cloned), S₁'s from each parent, 20 F₁'s (cloned), and F₂'s and backcrosses to each parent from each F₁.

Eighty plants each of the first 4 generations and 400 each of the last 4 gave a total of 1920 plants per cross. Individual plants were scored for degree of infection under a natural epidemic in the field. A range of 1 to 9 was used in scoring; class 1 had no pustules, class 5 had 50 to 75 pustules per leaflet, and class 9 had 200 or more pustules per leaflet on the most severely infected leaves.

The data were analyzed by comparisons among means of generations, by comparisons of actual with theoretical means, and by comparisons among means of F_1 clones and their F_2 and backcross progenies. The results may be summarized briefly as follows: In certain genotypes partial dominance of factors for resistance occurred; in others there was partial dominance of factors for susceptibility; and in some, interallelic interactions were evident. Dominance of factors for resistance was indicated by S_1 means for plants 2 and 4 higher than the mean of the cloned parents, while for plants 5 and 8 dominance of factors for susceptibility was indicated by S_1 means lower than the parents. The relatively high F_1 mean in cross 4 x 5 resulted from dominance of factors for susceptibility. Interallelic interactions were indicated by the relatively high means for F_1 , F_2 , and backcross generations in cross 4 x 2; each was higher than either parent and not significantly different among themselves.

Comparison of means of F_1 clones with their F_2 and backcross progenies gave supporting evidence for the conclusions of dominance of certain factors for resistance, of others for susceptibility and of interallelic interactions. On arranging the twenty F_1 means in cross 4 x 5 in descending order, it was seen that the higher scored F_1 had means higher than those of the F_2 and the backcross progenies, indicating the effect of alleles dominant for susceptibility. On the other hand, F_1 's with low scores had F_2 and backcross progenies with means higher than the F_1 , indicating dominance of alleles for resistance. Interallelic interactions were indicated in the case of the F_1 's with low scores which had means for the backcross to the resistant parent higher than the F_1 and also higher than the F_2 mean.

Breeding for Resistance to Rust: Ryegrass -
E. C. Holt, Tex.

Two approaches are being made to the problem in Texas. An original introduction from Uruguay, P.I. 193145, has been increased at the Beaumont Station and is being proposed for release and use at least until strains which show superiority are available from breeding programs. In the program at College Station, S_4 plants from seven S_3 lines that showed no rust in the field in 1955, have been isolated in the field for interpollination. Some S_4 plants are also being selfed.

Section III - Fertility Needs of Principal Perennial Legume and Legume-grass Mixtures of the Southeast,

D. S. Chamblee, N. Car., Chairman
H. D. Gross, N. C., Section Secretary

1:30 P.M. The Use of Soil Tests in Evaluating the Effects of Lime, Phosphate, and Potash in Experiments With Alfalfa and Ladino Clover
C. D. Welch and W. W. Woodhouse, Jr., N. Car.

The data presented in this discussion were obtained from experiments with rates of lime, phosphate, and potash on alfalfa and Ladino clover. The alfalfa experiments were on a Cecil clay loam and a Norfolk sandy loam, and Ladino clover on a Bladen silt loam and a Georgeville silt loam. Composite soil samples were collected from the experimental sites before the crops were planted, and again four years later. The results of analyses from these samples were correlated with percent of maximum yield.

A significant correlation was obtained between pH and percent yield. In most cases plots that gave the highest yield had a pH of 6.0 or above, except for the Bladen series. This soil has a rather high cation exchange capacity and would show a higher amount of total calcium and magnesium at a given pH as compared to the other soils. The soil-test results for calcium + magnesium have a slightly better correlation with percent yield than pH. Consideration of the amount of calcium and magnesium in the soil may be helpful in evaluating the effects of lime on these crops.

A significant correlation was obtained between percent yield and soil tests for potash where no potassium was applied. Where potash was top-dressed, the correlation coefficient was somewhat lower. Soil tests for potassium can be used to predict responses to potash applications, but with less precision where top-dressings have been made.

Even though a significant correlation was obtained between percent yield and soil tests for phosphorus, it is necessary to consider the type of soil if accurate predictions of phosphate response are to be made. Data are needed for more soils if the need for lime, phosphate, and potash is to be predicted over a wide area.

Discussion:

Taylor(Ky.): Have you noted any trouble with Ladino burning at high (400 lb/A) rates of potash application?

Woodhouse(N.C.): No, unless plasmolysis caused by heavy dew after application.

Taylor: In some cases we have killed Ladino with these rates.

Stewart(S.C.): Have you any indication whether plant tissue tests or soil tests gave a better predictive value?

Welch(N.C.): Dr. Woodhouse has some data bearing on this. We have noted increased K content after potash application.

Woodhouse: Using dry plant analysis, we feel that when approaching limiting levels, plant analysis may, in some cases, be quicker in anticipating deficiencies.

The past few years have brought about considerable improvement in the production of forage crops. Production has been greatly increased through better management and fertilizer usage on improved species. One of the greatest potentials, however, for a still greater increase in production is through better establishment methods. Establishment failures with forage, pasture, and hay crops are probably more commonplace than are establishment successes.

Most of the forage species are inherently slow in development, making establishment more difficult than with most other crops. Any principle which will help to speed up the early development of these seedlings will do a great deal to insure success of a new seeding. Recent investigations have indicated that establishment can be greatly improved through the band seeding method (a combination of drilling seed and banding fertilizer). These studies indicate the importance of the role played by fertilizers and fertilizer placement in the development of the young seedling.

A series of experiments were begun in 1952 at Beltsville, Maryland to study the effect of seed and fertilizer placement, fertilizer rates and ratios, and seed rates on the establishment of forage grasses and legumes. The object of these studies was to determine the effect of these variables on stands, early development, and production. An experimental seeder was designed and built by the Agricultural Engineering Research Branch with which precise placement variables could be made.

Dry matter yields were taken approximately 8 months after the 1952 and 1953 fall seeding of tall fescue-Ladino clover mixture. Broadcasting a complete fertilizer (750 lbs. 3-12-6) and seeding with a culti-packer seeder at the higher rate produced yields of 838 pounds and 1238 pounds in the 1952 and 1953 experiments, respectively. With fertilizer banded one inch below the drilled seed at the same rates, the yields were 3331 pounds and 2063 pounds, respectively, for 1952 and 1953. Banding fertilizer one inch below and one inch to the side of the seed produced 2443 and 1255 pounds of dry matter in 1952 and 1953, respectively, a significant reduction when compared to banding fertilizer directly below the seed. Complete fertilizer placed in contact with the drilled seed had no adverse effect on yields in the 1952 seeding but considerably reduced yields in the 1953 seeding which was followed by extremely dry weather.

Experiments with sericea lespedeza have indicated that both initial stands and yields are adversely affected by banding a complete fertilizer directly below drilled seed, especially when soil moisture is not adequate. Stand counts and yields taken in sericea seedings in 1953 and 1954 (2 extremely dry seasons) were significantly lower in the band seeded treatments than in the drill seeded-broadcast fertilizer treatments.

The effect of rates and ratios of the various fertilizer elements on forage establishment and performance has been demonstrated in experiments at Beltsville in 1953, 1954, and 1955 with mixtures of tall fescue-Ladino clover and sericea lespedeza-orchardgrass. The indications are that of

the three majorelements used alone, only phosphorus can be banded below drilled seed without adverse effects. Nitrogen and potassium used alone or in combination even at extremely low rates retarded early development of the seedlings and reduced yields in the first year significantly under conditions of both low and adequate soil moisture. Combining either one or both of these elements with phosphorus reduces the adverse effects significantly. The data have also indicated that phosphorus alone was as effective as a complete fertilizer in stimulating early development of the seedlings.

Another factor of importance noted in these studies was the effect of seed and fertilizer placement on weed competition. The weed population is greatly reduced where the seed is drilled and fertilizer banded. There are two principal reasons for this reduced weed population, (1) weeds receive limited benefit from the narrow bands of fertilizer placed directly below the seed and, (2) the soil is not compacted between the drilled rows, thus reducing weed germination and emergence.

Discussion:

Taylor(Ky.): What class of soil was used?

Hunt: Silt loam.

Taylor: Placement effects depend on soil and season. We have noted damage, using 30 and 60 pounds of N and K. If the fertilizer were broadcast, we got our best stands, but the response varied widely with available water. The results are difficult to interpret. Using sericea, with 900 pounds of 2-12-12 directly beneath the seed, we had out best stands in the test.

Hunt: Where water was low, using fescue-Ladino or orchard-Ladino, we noted no damage from banded (less than 800 lb/A) 3-12-6. With sericea, we have noted some damage, as we have with Ladino alone. At high fertility levels results have not been so striking, but just drilling the seed, as compared to broadcast, was advantageous.

Stewart(S.C.): With Sudangrass, comparing NK with NPK, the NK treatment killed the Sudan, but little damage was noted with the complete fertilizer. Water, per se, was not limiting.

Hunt: We have been able to reduce damage to seedlings by adding P to N K under dry or wet conditions.

Beatty(Ga.): What was the source of N used?

Hunt: Ammonium sulfate, in most cases.

Chamblee(N.C.): What broad recommendation, as regards analysis and rate, would you give for North Carolina?

Hunt: In Maryland, we recommend banding with P. Topdress, after established with K.

Chessmore (Okla.): We have noted similar results in Oklahoma. If we apply N or P alone, no response is obtained; together they're "terrific". This was using native summer grasses - blue panic, for example - and we found no winter survival on N alone, or with no treatment, but they came through all right with P alone.

Hunt: We cannot make too broad recommendations on the basis of these data.

2:40 P.M. * Fertility Needs of Ladino and Ladino-grass Mixtures -
W. W. Woodhouse, Jr., N. Car.

Results of two field experiments with pure stands of Ladino clover are presented - 4 years data on a Bladen silt loam and 5 years data on a Georgeville silty clay loam. Both soils were strongly acid and deficient in P, K, Ca, and Mg. Marked response was obtained to P, K and lime on both soils.

Annual applications of P were found to be essential on the Bladen but not on the Georgeville. Heavy at planting P application was helpful on the Bladen and very helpful on the Georgeville soil. Ladino, after establishment, was able to extract P with greater ease from the Georgeville.

Although the Bladen contained more Ex K in the beginning, yields declined sharply with time on the no K treatment, indicating little reserve K. There was no K response on the Georgeville the first season, and moderate response the second and third. Response became pronounced in the 4th and 5th years as the soil supply of K was depleted.

Lime response was pronounced from the beginning on the Bladen, with a sharp decline in yield after the second year. The one-ton rate followed the same general pattern as the zero lime but was still producing a 75% yield the 4th year. Lime response on the Georgeville was small until the 3rd season. By the 5th season the 2-ton rate doubled the yield.

Over a period of several years it would be necessary to apply about the same amounts of P and lime to maintain normal growth of Ladino on both soils. The Georgeville will need less K and annual applications of P are not so important on this soil. Phosphorus level at time of establishment is a major concern on both soils. Lime rate above one ton seems unimportant on both soils.

Discussion:

Ellzey (La.): When K was varied, at what rate was P applied?

Woodhouse: P rate was uniform; 200# P_2O_5 at seeding and 100# annually.

Hunt: Have you done anything on split applications of K?

Woodhouse: Yes, on alfalfa and Ladino. We have never noted any significant yield differences, perhaps some indication of differences in average K content. We tried this treatment to reduce luxury consumption, and the end may have been accomplished to a small degree. However, we never (on 8 years' alfalfa results) have obtained a yield difference.

Hunt: We haven't either, over a 4-year period.

Chamblee(N.C.): Has anyone found an advantage to split applications?

General opinion: Not for sure.

Hughes(Ga.): Have you noted any effects on the seeding habit of Ladino?

Woodhouse: We haven't taken seed yields. These crops were harvested before seed set; however, we haven't noted any bloom difference, even in drouth years, attributable to P.

Huffine(Okla.): Using superphosphate after establishment, have you compared super with rock phosphate?

Woodhouse: We have run a test on the Bladen (acid) series. After establishment, we have compared several forms of phosphate. This study is now in its third year. At very high rates of rock phosphate, we have noted some benefit; however, the soil was limed; it had to be to establish the crop. When we used fescue and Ladino, we noted no difference due to the mixture, as long as the clover stays with us.

Huffine: Is your yield curve flatter with rock than with superphosphate?

Woodhouse: We haven't carried this test long enough to be sure. So far, rock falls behind the soluble forms. Even with 4 times as much P_2O_5 from rock (1200 lbs. P_2O_5) this has been true. At low rates of application, rock phosphate is no better than the control. Now, after a few years, the high rate is catching up.

Taylor(Ky.): How many cuttings per year have you made?

Woodhouse: Usually 5 or 6. If the weather is dry, we may get only 3. The average is about 5.

Taylor: Does the annual production fluctuate more than the yields due to fertilization?

Woodhouse: Yes, sometimes we get no growth at all.

Chamblee(N.C.): What does the Georgeville release in terms of K?

Woodhouse: On the basis of previous experience, 50-75 lbs K_2O /yr. on most red Piedmont soils. On the Coastal Plains, on a longtime basis, we can expect none, once the native supply is exhausted (15-20 years of cropping).

Experiments conducted in Virginia show that during years when moisture is favorable and soils are low in potassium that it is possible in some soils to improve the yields by applying all of the potash after the first hay cut or half of it in spring and half of it after the second hay cut, when compared with the yields that were obtained with all of the potassium applied in spring.

More potassium is needed for alfalfa-grass mixtures than alfalfa alone because of the competitive absorption from the grass. If nitrogen is used on alfalfa-grass mixtures, it stimulates grass growth and aggravates the shortage of potash.

Experiments where very liberal applications of phosphorus were applied before establishment, are generally producing less than for plots where lighter applications were made annually.

Alfalfa does not have a larger requirement for boron than other legumes but it has a comparative low boron absorptive capacity.

It is possible to maintain good alfalfa stands over a long period of time through adequate application of lime, phosphorus, potassium and boron when cutting management practices that are favorable for alfalfa are used. Our experiments show that one omission of lime, phosphorus, potassium or boron would result in an alfalfa-grass mixture shifting to a stand high in grass and low in alfalfa. Likewise, cutting more than 4 times a year tends to shift the stand to a grassy population.

The protein, phosphorus and potassium content of alfalfa and grass is influenced more by stage of growth than by fertilization.

We should adapt the policy of fertilizing alfalfa-grass mixtures to get high yields and use cutting management practices that will produce the best possible quality (protein and mineral content and digestibility) and yet maintain the stand.

Discussion:

Elzey(La.): Regarding the data shown for percent Ca, the amount decreases with fertilizer rate. How can you attribute this to K, rather than to P?

Blaser: That statement was based on the result of other experiments.

Elzey: Was the depression due to K or Cl?

Blaser: Results of a greenhouse test with orchard-grass indicated that it was due to K.

Gross(N.C.): Is the carryover effect of N on alfalfa due to the increased potassium drainage caused by uptake on the part of the competing grasses?

Blaser: Yes, so we don't apply all our K at once. We need to study the K content of the alfalfa root system.

Welch(N.C.): Do you recommend splitting the K application on pure stands of alfalfa?

Blaser: No, it's not as important in that case.

Stewart(S.C.): At what level does K become critical?

Blaser: We have no data. Perhaps 1.5 - 1.75%.

Woodhouse(N. C.): We can't set one figure because of seasonal fluctuations. It may be best to maintain 2.0% K.

Blaser: Ward conducted a greenhouse test on orchard to determine the critical level. The yield increased with K content up to 3.5% in the wintertime. This may not be the same during the spring.

Woodhouse: K is least limiting in the spring, so it would seem best to apply K after the first cutting.

Chamblee(N. C.): Why are the K requirements of alfalfa different than those of Ladino?

Blaser: 1) The high yield potential of alfalfa, and 2) you take off the alfalfa as hay with no return through manure.

Chamblee: How much K is effectively returned to pasture?

Woodhouse: Effectively, not very much. And the yield potential may not be different, either. Actually, the requirements may be the same.

Blaser: Perhaps we shouldn't split the K application, but apply it all after the first hay cutting.

Elzey: Table 1 does not support the split-application theory. We have noted no beneficial results from splitting in Louisiana.

Chamblee: How much N was applied to alfalfa-orchard, and when?

Blaser: We are using 25, 50, 100 and 200 pounds before each cut and after each cutting. We are not recommending N on alfalfa, except where we get poor nodulation.

Chamblee: What does 100 lbs. N do when applied to alfalfa-orchard in March?

Blaser: During the first year, perhaps 1000 lbs. yield difference.

Elrod(Ga.): We have noted, after four years using N on alfalfa, 30 lbs. N at planting and after the first cut each year, -0.08 and 0.2T/A decrease each year, respectively.

Table 1. Hay yields (15% moisture) of an alfalfa-orchardgrass mixture as influenced by potash fertilization.

Potash (K ₂ O) applied		Location of experiments		
yearly for maintenance		Middleburg	Blacksburg	Charlotte
Lbs./A.	Time applied	Avg. 4 yrs.	Avg. 3 yrs.	Avg. 3 yrs.
0		6790	2470	4000
50	Late winter	8920	4290	5550
100	" "	9640	6560	6440
200	" "	9070	7120	7610
400	" "	8530	7580	8410
100	After 1st hay cut	9370	6450	7640
200	" " " "	9570	7220	8590
200	Late winter	9070	7120	7610
200	After 1st hay cut	9570	7220	8590
200	100 lbs. late winter &			
- - - - -	100 lbs. after 2nd cut	8480	6440	8150

Table 2. Hay yields (15% moisture) of an alfalfa-orchardgrass mixture as influenced by phosphorus fertilization.

Phosphorus (P ₂ O ₅) per acre		Location of experiments		
For establishment	For maintenance	Middleburg	Blacksburg	Charlotte
		Avg. 4 yrs.	Avg. 3 yrs.	Avg. 4 yrs.
0	0	5300	5510	6710
50	50	7710	6390	8040
100	100	8590	6530	7660
200	200	9870	6910	8310
100	50	7450	7320	7700
100	100	8590	6530	7660
200	0	8050	6850	7620
200	50	9000	6620	7860
200	100	8480	6440	8350
200	200	9870	6910	8310
400	0	8670	6750	7340
- - - - -	- - - - -	- - - - -	- - - - -	- - - - -

Table 3. Chemical composition of species in an alfalfa-brome grass mixture as influenced by fertilization and growth stage, Blacksburg, Virginia, 1953.

Species	Fertilizer	Growth Stage				Average
		Vegetative	Prebloom	Bloom	F. bloom	
		Phosphorus Content				
Brome	0-30-30	.37	.35	.35	.31	.35
	0-90-90	.41	.39	.36	.36	.38
	0-180-180	.44	.40	.38	.33	.38
	Mean	.41	.38	.36	.34	.37
Alfalfa	0-30-30	.41	.33	.28	.26	.32
	0-90-90	.49	.37	.31	.29	.37
	0-180-180	.51	.40	.36	.32	.40
	Mean	.47	.37	.32	.29	.36

Significant differences: Dates**, fert.**, species**, species x dates**, and species x fert.**

<u>Potassium Content</u>						
Brome	0-30-30	2.77	2.89	2.73	2.23	2.66
	0-90-90	3.20	3.28	3.29	2.70	3.12
	0-180-180	3.49	3.71	3.21	2.92	3.33
	Mean	3.15	3.29	3.03	2.62	3.02
Alfalfa	0-30-30	2.76	2.27	1.70	1.07	1.95
	0-90-90	3.66	3.44	2.61	1.73	2.84
	0-180-180	4.59	3.78	3.07	2.39	3.46
	Mean	3.67	3.16	2.43	1.73	2.75

Significant differences: Dates**, fert.**, species x dates**, and species x fertilizers**, species**.

<u>Calcium content</u>						
Brome	0-30-30	0.46	.47	.37	.50	.45
	0-90-90	0.41	.48	.31	.34	.38
	0-180-180	0.36	.39	.33	.33	.35
	Mean	0.41	.46	.33	.39	.39
Alfalfa	0-30-30	1.79	2.26	2.07	1.95	2.02
	0-90-90	1.58	1.84	1.59	1.53	1.64
	0-180-180	1.43	1.49	1.32	1.27	1.38
	Mean	1.60	1.86	1.66	1.58	1.68

Significant differences: Fert.**, species**, sp. x da.**, & sp. x fert.**.

<u>Protein Content</u>						
Brome	0-30-30	17.6	13.2	14.5	11.0	14.1
	0-90-90	19.3	15.0	13.1	10.6	14.5
	0-180-180	19.0	16.0	16.2	10.2	15.4
	Mean	18.7	14.7	14.6	10.6	14.7
Alfalfa	0-30-30	25.5	22.9	18.5	19.6	21.6
	0-90-90	28.0	24.4	17.8	17.7	22.0
	0-180-180	27.4	23.2	18.2	2.1.	22.5
	Mean	27.0	23.5	18.1	19.5	22.0

Significant differences: Dates**, species**, species x dates**.

T. H. Taylor(Ky.): We have 12 different soil areas and 3 experiments underway. At Simpson County, we have a study of P source and time of application; at Princeton, a test on rate and time of K application; and a third study on P and K, with rate and time of application as variables. We need more work on grass-alfalfa mixtures. Our recommendations are - for establishment - about 20# borax, about 20# N, 100# P₂O₅ and 100# K₂O, based on soil test. Topdressing - 600# 0-10-20.

Chamblee: We recommend 500# 0-10-20 to 800# 0-9-27, depending on the soil type, annually. (Table 1 and table 2 on next page)

4:00 P.M. Fertility Needs of Sericea Lespedeza - E. M. Evans and L. E. Ensminger, Alabama.

The response of sericea to various fertility treatments was determined at 8 locations in the state from 1948-1955. Yield differences due to treatments were obtained on only 3 of the 8 locations. Yield data from a test established in 1947 on the Tuskegee Field showed a significant response to lime and phosphorus for 1954 and 1955. Data from a test on the Sand Mountain Substation showed a significant response to phosphorus for the first time in 1955. Results from a test at the Lower Coastal Plain Substation show a significant response to phosphorus. Results from this test, which is the only one reported here that has a no-potash treatment indicates a response to potash.

Data are presented to show the response of cotton to potash following sericea which received varying amounts of potash. The response of cotton to potash decreased with increasing amounts of potash to sericea.

Discussion:

Stewart(S. C.): Have you noted a lime response? We got good response up to one ton of lime.

Evans: We have gotten a response on Boswell(acid) soils at Tuskegee.

Welch(N.C.): Have you noticed any difference in palatability?

Evans: We can't establish this from our tests. However, many farmer reports confirm the opinion that fertilizer improves palatability.

Woodhouse(N.C.): In an experiment on sand, with no previous fertilization, we noted a response to L, P, and K. We ran a palatability study, fed green to sheep last year, and got a large difference in favor of P-fertilizer sericea. The C.V. was high. The forage was fed free-choice, and we measured consumption and the time spent eating. The results were the same from both measurements. Without P, the consumption was reduced 30-30%. We noticed a smaller effect from L and K fertilized material. Now we are studying levels of P, rather than just with and without.

Stewart: What is the major problem in establishing sericea?

Evans: Scarification, extremely weak seedlings or major summer grasses (crab) moving in. It is also sensitive to high K. N gave some apparent stimulation in one case.

Question: Does seed treatment help establishment?

Evans: Maybe, we don't know. We can get our seeds up; it's not a damping-off problem. We seed in April after frost and can get them out, but not established.

Chamblee(N. C.): In North Carolina sericea is new. The literature says to plant in April, mainly. We've found early March successful in a few tests.

Evans: We've tried time of seeding. Sericea is not frost sensitive at the cotyledonary stage.

Taylor(Ky.): Early seeding seems best for us, too.

Evans: It's best when the water is favorable, and you can get in and reduce the competition.

Wednesday Afternoon, May 16.

1:30 P.M. Section IV. Producing, Harvesting and Storing Forage
Crop Seed - J. P. Craigmiles, Ga., Chairman

✓ After the plant breeder has developed a superior variety of a forage plant the job of producing, harvesting and storing seed or vegetative material of this variety in adequate quantities begins. If seed are not available, the variety, regardless of how superior, is of no value to the grower.

The three subjects discussed in this section are:

1. The National and State Foundation Seed Program - E. N. Fergus.
2. Maintaining, Increasing and Certifying Seed Stocks - P. B. Gibson.
3. Influence of Insects, Climatic Factors, and Cultural Practices on Seed Production of Forage Species - C. R. Owen.

× Panel Discussion on the National and State Foundation Seed Program - E. N. Fergus, Ky., Discussion Leader.

The National Foundation Seed Program is a plan, born of experience and necessity, for producing certified seed of any superior forage crop varieties in amounts required to supply regional or national demand, and beyond the production capacity of the state originating the variety. The plan is authorized and defined by the National Foundation Seed Project.

The National Project, approved in 1946, is an instrument of the United States Department of Agriculture and is under the leadership of the Field Crops Research Branch of the Agricultural Research Service. Currently, C. S. Garrison is the leader of this project. The Commodity-Stabilization Service of the United States Department of Agriculture is also cooperating in the operation of this project. It arranges for funds to finance the purchase of breeders and foundation seed through the Commodity Credit Corporation. The A. R. S. is responsible for the operation and coordination of the program with states under memoranda of agreement.

The National Foundation Seed Project is guided by an advisory committee known as the Planning Conference. The 16 members of this Conference represent the Agricultural Research Service and the Commodity-Stabilization Service of the United States Department of Agriculture, the American Seed Trade Association, the International Crop Improvement Association and the State Agricultural Experiment Stations. The Experiment Stations are represented by two members from each of the four regions of the country, each being designated by his Regional Forage Crops Technical Committee.

Arrangements within a given state for cooperative activities of that state and the project pertaining to seed production are the responsibility of the state foundation seed representative, who is appointed by the director of the state experiment station.

For a variety to be included in the National Project, it must be recommended by a state to its Regional Technical Committee, then by the Regional Committee to the Planning Conference of the National Project. The recommendation should be made on a form that is available from Mr. Garrison.

Producing the necessary amounts of Breeder's seed of a variety in the project is the responsibility of the originating experiment station. The Planning Conference of the project advises the leader of the project respecting the allocation of this seed for its most rapid multiplication into Foundation seed. Likewise, the Conference advises concerning the allocation of Foundation seed for the production of large quantities of registered or certified seed as the case may be. The last two classes are commercial seeds.

North Carolina Foundation Seed Producers, Inc. -
R. W. McMillen, N. Car.

I. Origin:

- A. 1945 - A group of farmers and seedsmen, interested in the production of North Carolina certified hybrids, met and organized this corporation, said corporation to be a self-supporting, non-stock, non-profit organization.

B. Organization

(a) By-Laws stipulate:

1. Membership

"Any person, firm, partnership, corporation or association be granted a membership on a life basis upon payment of a \$10.00 membership fee or on an annual basis with a \$1.00 Membership, and who agrees to abide by the By-Laws and Operational Policies."

2. Seven member Board of Trustees control management of corporation.

3. Board of Advisory Trustees.

(a) Ex-officio active members; Dean of Agriculture, Director of Research, Director of N. C. Crop Improvement Assn., President of N. C. Crop Improvement Assn., and one member of the following: Head of Field Crops, Agricultural Extension Service, plant breeders connected with Experiment Station and USDA.

4. Duties of Manager.

(b) Memorandum of Understanding between the N. C. Agricultural Experiment Station and N. C. Foundation Seed Producers, Inc. The Station recognizes the Foundation as a qualified agency for the production and distribution of foundation seed of new crop varieties developed by the Station.

1. Title to all unreleased strains of any crop which is being increased by the Foundation shall remain the property of the Station until said strain is formally released for distribution.

2. Each initial transfer of lots of seed of an improved crop strain from the Station to the Foundation be covered by a supplemental memorandum covering the specific details as to kind, quality, purposes, restrictions etc., concerning said strain.

3. Financial status of the Foundation shall be reviewed annually and when found in excess of operating expenses surplus will be used for the promotion of research in the field of crop and seed improvement.

II. Purpose:

A. To cooperate with the North Carolina Agricultural Experiment Station and the United States Department of Agriculture in making available to the farmers of North Carolina new and improved field crops seeds and to obtain such improved seed stocks by purchase, barter, lease, or gift; to propagate and increase the same through any agency and particularly by contracting with producers and institutions; and to disseminate such increased stocks to its members and others.

- B. To provide that there is available annually to North Carolina producers of field crops seeds, certified foundation seed stocks of the best known corn hybrids and crop varieties adaptable to North Carolina climate and soils in adequate quantities and at reasonable prices.

III. Procedure:

- A. Breeder seeds furnished by the North Carolina Agricultural Experiment Station.
- B. Foundation seed grown under contracts between farmers and the Association.
- C. Foundation fields inspected by North Carolina Crop Improvement Association.
- D. Foundation seed dried and processed in Corporation's warehouse.

IV. Crops Handled:

- A. Hybrid seed corn (15 different varieties).
- B. Small grain.
 1. Barley - Colonial #2 and Davie.
 2. Oats - Arlington.
 3. Wheat - Atlas 66, Atlas 50, Anderson, Taylor 49 and Knox.
- C. Tobacco seed - All varieties developed by the Experiment Stations.
- D. Soybeans - Jackson, Lee, and Roanoke.
- E. Peanuts - N. C. 1 and N. C. 2.
- F. Lespedeza - Rowan.
- G. Irish Potatoes - Boone (initial distribution in 1956 only).
- H. Cucumbers - Smoothie (initial distribution in 1956 only).

V. Goal:

To make available Foundation seeds of new and improved varieties of field crops developed or approved by the North Carolina Agricultural Experiment Station for use by members in the production of certified seed and to maintain Foundation seeds of certified varieties developed by experiment stations.

VI. Flow Sheet:

N. C. Agric. Exp. Sta.			
Agric. Exp. Stations	N.C. Foundation	N. C. Crop	N. C.
in other states	Seed Producers	Improvement	Farmers
National Foundation	Inc.	Assoc.	
Seed Projects			
Development of new crop varieties	Multiplication, distribution, & Maintenance	Certification, Educational & Promotion- al work	Assure . "Certified Seed". Adapted seed of high gen- etic purity, germination & perform- ance.
Breeders seed and foundation seed			

Genesis of National Foundation Seed Project -
E. A. Hollowell, Beltsville, Md.

The National Foundation Seed Project began in 1934 as an outgrowth of three factors: (1) Unadapted seed from the West was sold and used on farms in other sections of the country; (2) Seed of early increases of adapted varieties was being used for commercial plantings rather than for seed production; and (3) Some organization was needed to insure that seed of adapted varieties in poor seed-producing areas be multiplied in areas of high seed production and returned to the areas of adaptation. A detailed history of the project and its function was presented.

The Responsibility of Maintaining Breeder Seed -
N. L. Taylor, Ky.

It is the responsibility of the breeder at the originating station to maintain breeder seed in sufficient quantity to supply the need of growers within the state of origin, and, when the variety is in the National Foundation Seed Project, to supply the need of growers in other states.

It is also this breeder's responsibility to cooperate with the National Foundation Seed Project representatives in ascertaining that the variety does not lose any of its desirable characteristics during seed increase. The registered class of seed has been eliminated in the seed increase program of several varieties to fulfill this objective.

The production of sufficient breeder seed in the originating state without several increase generations is sometimes difficult because of poor conditions for seed production. In some species this difficulty has been overcome by the transportation of vegetative breeding material to western United States. An experimental approach is under way with Kenland red clover at the Kentucky Experiment Station to determine if seed can be produced in such a manner.

2:30 P.M. *Panel Discussion on Maintaining, Increasing and Certifying Seed Stocks - P. B. Gibson, S. Car., Discussion Leader

Plant breeders are personally interested in these phases of the seed picture because the future of a new variety depends upon maintaining, increasing and certifying seed stocks. The contribution of a plant breeder is almost worthless without a reliable program for increasing the seed of a new variety.

The need for reasonably uniform policies and responsibilities concerning the development, evaluation, release, and increase of seeds of new varieties developed by public supported institutions and agencies was recognized years ago. In 1954, the Seed Policy Subcommittee of the Experiment Station Committee on Organization and Policy developed A Statement of Responsibilities and policies Relating to Seeds. Dr. R. D. Lewis of Texas represented the southern region on this committee.

This statement was intended as a guide for the further development of policies and procedures in individual states. It did not obligate any specific state nor affect the right of the individual state station to make adaptations covering the specific needs and situation of that state. The subcommittee also recognized that adaptations to specific crops would be necessary.

The state representative at the Seventh Work-Planning Conference of the Southern States Collaborators of the United States Regional Soybean Laboratory, March 1955, approved a policy to guide the increase, release, and maintenance of new varieties of soybeans. The policy which they approved is an example of the adaptation of the subcommittee's statement to a specific crop.

The members of the above groups devoted much time and study in the development of their statements. The ideas in their statements should help us improve our activities and services in the development and use of new varieties of forage crops.

Some or most of you indicated to the program committee that you would like for those who have released a new variety of a forage crop and those concerned with the maintenance and increase of such varieties to discuss the plan they are following. Because of limited time all varieties could not be discussed. It is believed that the varieties to be discussed by the members of the panel are representative of the different types of forage crops.

Maintaining, Increasing and Certifying Stocks of Vegetatively Propagated Grasses - G. W. Burton, Ga.

Effective certification of vegetatively propagated grasses in Georgia has involved the following steps:

1. Application is made to the Crop Improvement Association by the would-be grower.

2. Two inspections are made by the Crop Improvement Association at 6-week intervals of the field where the new grass will be planted to insure freedom from noxious weeds, other varieties of the species to be planted, or other undesirable plants.

3. Following approval by the Crop Improvement Association, the field is planted to pure foundation stock purchased from the Experiment Station or an approved seed-stocks organization. Certified stock cannot be used to plant certified fields. The registered class has been eliminated for turf grasses. In practice, very little registered stock has been used to plant certified fields of pasture and hay grasses.

4. All certified fields are inspected annually.

5. Unannounced spot checks are made during the merchandising season to insure that stock being sold is meeting the minimum requirements for certification.

Pasture and hay grasses are usually sold by the thousand sprigs or by the bushel or cubic foot. Turf grasses are usually sold by the square yard.

Maintenance of Parent Clones

Parental clones of Louisiana Sl white clover are kept in pure vegetative stands in plots on the Experiment Station farm at Baton Rouge. This is accomplished by managing the plots so that vegetative cover is maintained throughout the year and seedlings cannot develop. This is done by transplanting clone pieces in an area of 10.5 sq. feet within the center of a plot having a total area of approximately 200 sq. feet. The plot is covered by vegetative increase of the clone. Material used for transplanting is collected from the outer edge of the plot so that the most recent growth is taken. Every other year the clones are transferred to fresh plots which are free of white clover.

Establishing Breeder Seed Blocks

Breeder seed blocks are established by transplanting clone pieces into rows. The distances between the rows is 42 inches. Clones are transplanted one line to a row about 21 inches apart in the drill. Transplanting is always done after cool weather begins in the fall. There are five lines used in the formation of Louisiana Sl, consequently the transplanting is made in sets of 5 rows. The lines occur in random order in each set of rows except a restriction is made in order to prevent the occurrence of two rows of the same line side by side. That is, if line 5 is transplanted on the last row of a set this line would not be planted on the first row of the next. The size of breeder seed blocks is $1\frac{1}{2}$ to 2 acres.

Honey bees for pollination are supplied by the Southern Bee Laboratory. Three to 4 strong colonies are located on the edge of the field. Seed is harvested from the entire block enmasse by a combine in which no other white clover seed harvesting is permitted. Cleaning, processing and bagging is done on cleaning machinery used only for this variety of white clover.

Foundation seed is grown from the breeder seed. It is planted on the farms of the Branch Experiment Stations. Almost all of the foundation seed during the past has been produced by the Rice Branch Station located at Crowley. These blocks, usually 10 to 15 acres in size, also have been changed and new blocks planted every second year. Foundation seed are threshed, cleaned and bagged on equipment owned by the Experiment Station.

The Crop Improvement Association of Louisiana distributes foundation seed to the farmer grower and supervises the planting and growing of the seed. Inspection for certification as well as seed sampling for laboratory tests are supervised by representatives from the office of State Commissioner of Agriculture which also issues the tags.

Maintaining and Certifying Foundation Seed of Dixie Reseeding
Crimson Clover - J. M. Elrod, Ga.

Origin of Dixie Reseeding Crimson Clover

Dixie Reseeding Crimson Clover is a synthetic variety made by mixing seeds of three strains having similar characteristics for maturity, productivity, volunteering ability, freedom from diseases and range of adaptation. These were selected from a group of more than 30 volunteering strains after a period of testing at experiment stations throughout the Southeast.

The three strains composing Dixie had records of having volunteered for more than 25 years prior to the initiation of the tests. The Allen strain dates back to about 1890, Thornton to 1904, and the Hardy strain to 1907. In 1945, the Georgia Experiment Station composited seed of these strains into Dixie Reseeding Crimson Clover. This was distributed to a few farmers for the production of registered seed. Fifty acres of each strain were established on the Eatonton Project for maintaining a source of foundation seed. This foundation seed is inspected annually by the Georgia Crop Improvement Association. After harvest, the seed are processed and bagged at the Experiment Station. The State Seed Laboratory makes the purity analyses and germination tests. Reports are sent to the GCIA by the Seed Laboratory and the tags and seals are issued. These seed are distributed by the Agronomy Department to farmers who are encouraged to produce certified seed.

Volunteering ability is the distinguishing characteristic of Dixie Reseeding Crimson Clover. The first seed crop harvested from Foundation seed are classed as Registered seed. The first seed crop harvested from fields planted with Registered seed and all seed crops harvested from volunteering stands established with Foundation, Registered or Certified seed are classified as Certified seed.

Maintaining, Increasing and Certifying Seed Stocks-(Auburn
Reseeding Crimson Clover) - E. D. Donnelly, Ala.

Auburn Reseeding Crimson Clover was developed by natural selection. Sometime before 1920 crimson clover was planted on the Agricultural Experiment Station of the Alabama Polytechnic Institute and several years later it was observed that the clover volunteered on the edges of the field on which it was originally sown. It continued to reseed on the same area until 1941, at which time it became necessary to give up the original area. The clover was then established on a 1/8-acre field on the Agronomy Farm in 1941 and it has been volunteering there since that time.

Fifteen to 20 pounds of seed is normally harvested from the 1/8 acre each year. Each year this seed is hand planted in rows on 2 acres that have never been in crimson clover or on an area which has been clean-cultivated for a number of years. Foundation seed is produced from breeder seed at the Thorsby Foundation Seed Stocks Farm under close supervision by representatives of the Experiment Station. Foundation seed can be harvested from the field sown with breeder seed as long as volunteer stands are maintained. Foundation seed is supplied to members

of the Alabama Crop Improvement Association for the production of registered and certified seed. Registered seed can be harvested from fields sown with foundation seed as long as volunteer stands are maintained. Likewise, certified seed can be harvested from fields sown with registered seed as long as volunteer stands are maintained. The second and all continuous reseeding crops harvested from fields established with certified seed are eligible for certification. The first year seed crop produced from plantings made with certified seed are not eligible for any class of certification.

Varieties Developed by and Availability of Seed Stocks from
Agronomy Department, Georgia Experiment Station, 1936-1956.

S. V. Stacy, Ga.

The release of a new variety or hybrid involves many problems and responsibilities. A new variety should be equally as good as older varieties in every way and, in addition, superior in one or more characteristics when grown in the area where it is recommended. The seed or other end products should be of high quality and an ample supply of seed at reasonable prices should be made available to the farmer.

One of the first breeding programs to bear fruit at the Georgia Agricultural Experiment Station was with small grain. Many years of research and testing were required before any new varieties were released. The first variety of wheat, called Gasta, was released in 1936. This was a very popular variety and was grown for many years. The second variety of wheat released was Sanford. It, too, met with great favor with growers, not only in Georgia, but in other states as well. This variety is still being grown by quite a few farmers. The third improved variety, Chancellor, was released in 1948 and has been by far the most popular variety.

In 1936 an oat variety named Terruf was released. It was an improved red rust-proof selection and is still being grown in many areas of the state. The latest varieties of oats released are Arlington and Atlantic. They are very similar in growth characteristics and productivity, the only difference being in the color of the seed. The Atlantic is slightly more cold resistant, but not enough to be of economic importance. Arlington has been more popular and is well suited for grazing as well as hay and seed production. Arlington oats have made the highest yield of any on the station, the yield being 170 bushels. acre

A new variety of soybeans, named Gatan, was released in 1940. This variety was tan in color and recommended primarily for hay and soil improvement. It is still a popular variety. In 1951, a yellow soybean with the same growth habits and yield potential as the Gatan was released. The characteristics of the yellow soybean were so similar to the Gatan that it was named Yellow Gatan. The yellow Gatan serves as an all purpose soybean. Both beans do exceptionally well after small grain. A very popular oil bean, named Jackson, was released in 1954. It makes very good hay if cut in the heavy bloom stage. The Lee variety, also for oil, was released the same year as Jackson, but has different growing habits in that it is earlier and fruits nearer the ground. The yield ability of the two beans is about the same.

Dixie crimson clover was released in 1944. By 1951, in Georgia alone, over one million acres were planted to this crop and the acreage has subsequently increased. It is a reseeding winter legume adapted to all areas of Georgia, and used for soil improvement, grazing and forage.

The year 1944 produced another great variety with the release of Empire cotton. Empire cotton has a staple length of one inch or better, large bolls, is easily picked, is early in fruiting habits, produces 40 percent lint, and is wilt resistant. It is grown in all the cotton states except California. It is also popular in several foreign countries. The breeding program for this variety has continued and improvements are regularly being released to farmers under the original name of "Empire".

In 1948, a white corn hybrid, named Georgia 101, was released. This hybrid has led in the 100-bushel corn content for many years. Georgia 101 is recommended for the Piedmont and Mountain areas. In 1950, another white hybrid, Georgia 103, was released, and is recommended for the Coastal Plain, because it is more weevil resistant. This hybrid also does well in the Piedmont and Mountain areas of Georgia.

In 1936, an open pollinated sweet corn named Cherokee Sweet was released. It will not compete with the real early varieties and hybrids for the spring markets, but does produce high yields and is excellent for canning and home consumption.

The Agronomy Department cooperates with the Plant Pathology Department in the multiplication and distribution of Romack Winter Peas. The Romack Winter Pea has growth habits similar to the Austrian Pea. The advantage of the Romack is that it is earlier and produces a large seed crop. Yields at the Station have been 1500 pounds of seed to the acre. Foundation seed are available to farmers of this excellent winter cover crop. The Plant Pathology Department also developed the following varieties of peanuts: Dixie Spanish, G.F.A. Spanish, Southeastern Runner 56-15, Virginia Bunch 67, Virginia Bunch G2, Virginia Runner G26, and Georgia 119-20.

The only variety distributed by the Station and not developed by it is Redbine 60 grain sorghum. Realizing that this crop has a place in Georgia's agriculture, the Station obtained foundation seed from the Texas Experiment Station and produced registered seed that have been certified by the Georgia Crop Improvement Association.

It takes considerable time and money to develop new and superior varieties of crops. Unless these new varieties get into the hands of farmers in large enough quantities to be of economic importance, everything has been wasted. The Department has long realized this and has made available, annually, large quantities of foundation seed stocks. This program was in operation many years before the Georgia Crop Improvement Association was organized, and gave excellent base for such an organization to work from. Today the Georgia Experiment Station is cooperating whole-heartedly with the Association.

There has been no other investment that has paid greater dividends from the taxpayers' money than that invested in research devoted to the development of new crop varieties. For every dollar spent, the increased income to Georgia farmers has been multiplied many, many times. For

example, the annual increased income from Dixie Crimson Clover alone is from seven to ten million dollars.

Crop Varieties in the National Foundation Seed Project -
E. N. Fergus, Ky.

The following varieties of alfalfa are in the project: Buffalo, Ranger, Atlantic, Narragansett and Vernal. Three varieties of red clover are in the project: Kenland, Pennscott and Dollard. Other forage crop varieties in the project are Climax lespedeza, Potomac orchardgrass, and Starr millet. Tift sudan grass was removed from the project in December, 1955. The project made possible, in large measure, the production of about 230,000,000 pounds of certified seed of the varieties of alfalfa in the project from 1950 to 1955 and of about 18,000,000 pounds of certified seed of the red clover varieties in the same period.

3:45 P.M. ^x Panel Discussion on the Influence of Insects, Climatic Factors and Cultural Practices on Seed Production of Forage Species -
C. R. Owen, La., Discussion Leader.

The Value of Honeybees for the Production of Crimson Clover Seed - C. M. Beckham, Ga.

Results of 2-4 years' work at 3 locations in Georgia show that populations of wild pollinating bees do not build up to large numbers by the time crimson clover is in bloom, and that for maximum pollination and subsequent high seed yields, it is necessary to utilize honeybees. Increased yields of seed per acre from the use of honeybees have ranged from 162 to 561 pounds. Converted to percentage increases, this has ranged from 238 to 474 percent. The value of the increase, figuring seed at 20 cents per pound, has been \$32.40 to \$112.20 per acre. Two papers giving procedure and results of these studies are available upon request. J. H. Girardeau, Jr., Apiculturist, Coastal Plain Experiment Station, Tifton, is project leader of this work.

The Effect of Harvesting and Processing on the Hard Seed Content and Abnormal Seedlings of Crimson Clover - H. D. Bunch, Miss.

Phase I. The cumulative effects of harvesting and processing upon hard seed and abnormal seedling percentages.

Non-defoliated crimson clover was harvested with combine cylinder speeds of 850, 1050, and 1250 r.p.m. The harvested seed was then processed consecutively through a cup-type elevator, an air/^{and} screen machine, again through a cup-type elevator, and a roll mill. Germination samples were taken after each operation to determine the percent of scarification and mechanical injury caused by each machine.

Effect of Cylinder Speed on Hard Seed - As the cylinder speed was decreased from 1250 to 1050 to 850 r.p.m., the hard seed content of the seed increased from 13.2 to 19.8 to 31.6 percent, respectively.

Effect of Processing on Hard Seed - The various processing operations had no further effect on the percent of hard seed in crimson clover harvested at 1050 and 1250 r.p.m. Although the 850 r.p.m. cylinder speed allowed 31.6 percent of the seed to escape scarification, subsequent processing reduced this percent to 22.7.

Effect of Cylinder Speed on Abnormal Seedlings - The 850 r.p.m. cylinder speed resulted in no significant increase in the percent of abnormal seedlings over hand-rubbed seed. The 1250 and 1050 r.p.m. cylinder speeds gave highly significant increases in the percent of abnormal seedlings over the 850 r.p.m. cylinder speed.

Degrees of Hard Seededness Possible - There was a direct relationship between the cylinder speed and the hard seed and abnormal seedling percentages. As the seed was exposed to an increasing number of impacts there appeared to be a definite sequence in the factors which cause a hard seed to be scarified, a scarified seed to be mechanically injured and a mechanically injured seed to become a dead seed.

Effect of Cylinder Speed on Yield - Because of the resulting loss in seed yield, it proved uneconomical to reduce the cylinder speed of the combine below 1250 r.p.m. in order to obtain an increased percent of hard seeds. Changes in the harvesting and processing equipment, such as altering the type of surface on the cylinder bar, designing a cylinder bar which would give a longer and lighter rubbing action, increasing the number of cylinders, or reducing the drops and rough surfaces in the processing equipment, were recommended as possible means of reducing losses in yield and hard seed content.

Phase II. The effect of individual processing machinery upon hard seed content of hand-rubbed seed.

Seed from defoliated and non-defoliated crimson clover plants was hand harvested and hand rubbed. These seed were then processed through an air and screen machine, a roll mill, a cup-type elevator, and an air elevator. As the seed passed from each machine, samples were obtained and the hard seed and abnormal seedling contents were determined.

Hard Seed - Each of the processing machines produced a highly significant decrease in the hard seed content when compared to hand harvested unprocessed seed. The results showed that the air and screen machine, the roll mill, the cup-type elevator, and the air elevator scarified 7.4, 11.1, 12.8 and 95.2 percent of hard seed, respectively.

Abnormal Seedlings - The number of abnormal seedlings was less than one percent irrespective of treatments. Although this difference was sometimes statistically significant, it was of no practical value.

Influence of Insects, Climatic Factors and Cultural Practices on Seed Production of Forage Species - J. R. Harlan, Okla.

Four years of intensive research on seed production under irrigation in Oklahoma have led to the following conclusions:

1. Each species, and sometimes each variety, is a special case and responds in its own way. Generalizations are difficult.

2. Time of blooming is extremely important in some species. In Oklahoma for blue grama to set seed well it must be brought into bloom in September. This is done by mowing and/or grazing until mid-August, then deferring, fertilizing and irrigating. Earlier irrigation inhibits the seed crop. Time of blooming is important in other species also.
3. Many native species can be readily overfertilized. For blue grama, side-oats grama and buffalo grass, 50 lbs. of N. per seed crop is about all the plant can use efficiently.
4. Some grasses respond well to very heavy applications. Blue panic produced over 800 lbs. of seed with 720 lbs. of N. At the higher rates, each additional pound of N increased seed yields by 1 lb. Maximum potential has not yet been determined
5. Split applications are often more efficient than single ones. In switchgrass, 70 lbs. N applied in split application (one at start of growth and one at boot stage) was equivalent to 100 lb. N in one application.
6. Studies on delayed blooming in sand bluestem, switchgrass, and sand lovegrass indicate that in most years the normal seed crop will yield the most, but in some years hot, blasting winds will cut the early crop and a later one will yield more seed.
7. Insects may be important in several grasses. Control of thrips (mostly Chirothrips falsus) and gall midges (Cecidomyidae) has improved seed set in blue grama in Oklahoma, Bermudagrass in Arizona and Rhodesgrass in Texas. Side oats grama and switchgrass are probably also affected. Dieldrin was most effective in the Oklahoma and Texas studies. Severe damage to crested wheatgrass by the brown wheat mite has been observed, and controlled by parathion.
8. The use of bees for pollinators increases seed set in vetch and alfalfa, but only in very favorable years when seed yields are high does it pay for alfalfa in Oklahoma.
9. The culture of both grasses and legumes in rows and furrow irrigation is recommended for Oklahoma conditions. Buffalograss and blue grama may be exceptions.
10. Profitable seed yields may be obtained for most species with suitable management. Expected yields under irrigation in Oklahoma are approximately as follows:

Blue panic	700-800 lbs/A	Bromegrass	500-600 lbs/A
Switchgrass	500-600 "	Sand bluestem	300-400 "
Sand lovegrass	600-700 "	Weeping lovegrass	800-1000 "
Side-oats grama	500-600 "	Alfalfa	200-600 "
Blue grama	300-400 "	Astragalus cicer	200-300 "
Buffalo grass	800-1000 "		
11. Climatic hazards include wind, rain, hail and high temperatures at blooming time. Under irrigation, rain can be severely damaging.

Influence of Cultural Practices on Seed Production of
Sericea Lespedeza, Crimson Clover and Tall Fescue -
R. M. Patterson, Ala.

Average seed yields of sericea lespedeza for 3 years following establishment by sowing 25.0, 37.5 and 50.0 pounds of unhulled seed per acre were 435, 558 and 600 pounds, respectively. For seed production, 6-, 12- and 18-inch row widths were superior to 24-inch row widths. The 12- and 18-inch spacings were better than 6- and 24-inch spacings for forage production.

In a frequency and time of cutting experiment it was found that cutting sericea more than twice for hay or cutting twice late in the season resulted in reduced stands and practically no seed. A fair hay yield and the highest seed yield was produced when only one cutting of hay was made. This experiment, however, did not include a treatment which was not cut at least once for hay.

Applications of 10 pounds of borax per acre annually gave maximum increase in crimson clover seed yields on 4 coarse-textured soils in Alabama. No significant increases in seed yields were obtained by application of borax to two fine-textured soils that were higher in native boron.

Each increment of 16 pounds of nitrogen per acre up to 64 pounds applied in the spring increased the seed yield of tall fescue in a 3-year study. Spring applications were more effective than fall applications, especially when forage was utilized in the winter.

Influence of Climatic Factors and Cultural Practices on
Seed Production of Dallisgrass - E. C. Holt, Texas.

Work in Texas has been almost exclusively with Dallisgrass. Work with vetch has been unsuccessful because of drouth. Earlier work has shown that Dallisgrass seed quality is best at College Station in May and June before temperatures exceed 85-90° F. and relative humidity drops below 30-40 percent. An early spring application of nitrogen increases the June seed crop but decreases subsequent crops. Work in 1955 indicated that Dallisgrass could be grazed or harvested for hay in May without decreasing the June seed crop provided adequate nitrogen was used; however, caryopsis weight was decreased. The influence of smaller caryopsis size on seedling vigor has not been studied. A study of inflorescence production and the influence of time of nitrogen application on distribution of this production was also started. Maximum inflorescence production occurred in late June and early July and again in mid to late September in 1955. Nitrogen did not influence the distribution of inflorescence production. This study is being continued.

7:30 P.M. Banquet - Elks Club, on Highway 19, two miles south of Griffin. Dr. G. P. Donaldson, Pres., Abraham Baldwin Agricultural College.

Section I. Forage Evaluation, Second Session -

O. E. Sell, Ga., Chairman

W. B. Anthony, Ala., Section Secretary

8:00 A.M. ^X Plant Evaluation Preliminary to Breeding for Improvement -
W. V. Brown, Texas.

Plant evaluation preliminary to breeding should consist of an investigation of all aspects of the biology of the species or strain. Many biological characters may be of such a nature as to modify the breeding techniques employed or to prevent breeding work entirely. Apomixis, cleistogamy, seed sterility, poor seedling establishment, and self sterility all directly affect the breeding program. Adequate evaluation of the plants should determine the presence, absence, and nature of such factors and characterize them.

Under semiarid conditions the characteristics of plants that permit them to survive under the adverse environmental conditions are more important in determining the overall value of the plants than chemical composition. Examples are given of the greater value of low quality grasses than of high.

There is a possibility that studies of stomatal behavior, leaf anatomy, root systems, and photoperiodic responses might contribute valuable information to plant breeders in their attempts to produce better forage types

Specific Approach

8:45 A.M. ^X Are Elaborate and Expensive Animal Grazing Trials Necessary in Order to Establish Recommendations for Fertilizer and General Agronomic Practices for Grazing Crops? ^X
R. E. Blaser, Va.

This problem cannot be answered with certainty. Animals must be used to establish index values of forage species and mixtures as measured by quality, digestibility and palatability in relationships to reproduction, liveweight gains, milk production, etc. If reliable information on these factors is available for different stages of growth of species and mixtures, then it may be possible to interpret clipping techniques in terms of animal results. Clipping techniques that simulate strip grazing or grazing management practices where there is a short grazing period followed by a long rest period, would be expected to correlate highly with grazing experiments. On the other hand, for the short species that are grazed more or less continually, it is difficult to get high correlations between grazing and clipping methods.

Animals are harmful to pastures in that they over and under graze, tramp the sod and compact the soil. In general, higher yields will be expected from clipping experiments than for grazing experiments. In grazing experiments the fertility is more favorable for high production than for clipping experiments because much of the animal excreta is returned to the soil with the former technique. If very carefully

managed clipping experiments are employed, the information will be very useful in guiding the management of species and mixtures under grazing conditions.

Discussion

Carter(Va.): Clipping plots gives total yield but may not give good information on seasonal distribution. Is this correct?

Blaser: The two techniques differ, but clipping may give fair results. Grazing never removes all herbage so clipping may give a better growth picture.

McCullough(Ga.): Grazing would be more satisfactory provided the background is known.

Blaser: We must know the animal behavior background to properly interpret results.

Burton(Ga.): We are concerned with relative values rather than exact value. You state grass was inferior to clover. What was the measure?

Blaser: Beef gains having an order of difference of $\frac{1}{2}$ lbs. per day.

Woodhouse(N.C.): What do you do on effect of animal on fertility status? Our work is on the influence on fertility status while New Zealand reports on a botanical basis. North Carolina data shows that grazing animals fail to influence the fertility status because of the distribution problem. We quit returning clippings because they seemed to foul up the results some.

Blaser: Overestimating fertility is required under grazing conditions.

Woodhouse: While the results are relative we hope to get in the neighborhood of needs.

Burton: With good information on background, clipping may give information the animal does not give.

Taylor(Va.): There was 9 percent more herbage on clipped than on grazed plots during the first two years at Middleburg, indicating that results with the mower are similar to grazing results on botanical composition and yield.

Blaser: Bluegrass yields were of little value when clipping was at $2\frac{1}{2}$ inches high. Height when cut and height of cut are extremely important.

Chamblee(N.C.): Suppose 300 lbs. of beef were obtained from fescue and 350 from mixtures; while this difference was small, all gave good yields. Comparisons here were not important, but rather finding the place of different plants. Fescue alone gives more yield than the mixture in late fall and early spring. Small differences do not always mean that certain species should be eliminated.

Sell(Ga.): Knowing the trend of yield from clippings is of value in planning the grazing program.

Taylor: Small plots can be used to estimate the feed program and the background for grazing work can be laid with clipping methods.

Question: Would differences between animal and clipping results be due to other factors, such as compaction, etc.

Blaser: After grazing, new growth comes from food reserves stored in the plant. Orchard grass stores reserves in stubble. With 2-inch cutting the mower takes two inches while the cow grazes from one to perhaps 9 inches, with slow recovery on overgrazed spots. The fertility returned counteracts this some. Compaction may either help or harm, depending on the species. Bluegrass seems to store in the rhizomes, with alfalfa the same.

Sell: It is not as easy to maintain a mixture as a pure grass stand.

Blaser: Top-grazing cows give more milk than bottom-grazers, indicating that the stage of growth may influence palatability. Animals usually prefer the younger growth.

McCullough: Digestibility went up with increase in amount of N and dropped off at high levels. Increasing protein without replacing crude fiber is of little value. You do not necessarily get a drop in crude fiber with an increase in protein.

Sell: One trouble with fescue is that it is high in crude fiber and low in available energy.

Burton: Increase in stem increases the crude fiber content and lowers the available energy.

9:30 A.M. *Can Practical Application be Made of Zero Grazing in High Producing Dairy Herds in the Southeast? - G. C. Graf, Va.

Zero grazing means bringing fresh green chopped or long forage to the livestock for their consumption. Other terms used are green chop, green feeding, soiling, and bunk feeding of green forage. It is not used extensively throughout the United States, although it is gaining in popularity. It is probably used most extensively among the large herds in California.

There are a number of advantages for this method of feeding, such as greater yields per acre, more uniform milk production, reduced fencing costs and increased consumption of green feed during the hot summer months, when compared with grazing.

There are also a number of disadvantages, such as need for expensive equipment, greater labor costs, not adapted to stony or hill land and adapted only to large herds.

A review of experiments conducted in California, Indiana, New Jersey and Minnesota was also presented.

The practice of zero grazing appears to have a place in a grassland farming program as carried on in the Southeast. It is actually a refinement of such a program and should be considered by the larger dairy herds, especially during the hot summer months when cows are reluctant to graze.

Discussion:

Neathery(Ga.): What is the D. M. intake with this method?

Graf: It is a matter of greater D. M. intake.

Blaser: Early California work showed no difference in the first work. Later work showed strip grazing to be the best, but selective grazing also occurred.

Stone(La.): Louisiana practiced soiling for two years. Cows take in 140 pounds at the beginning of the period and 70 at the end, but the D. M. intake is the same. There is no difference in production. The cow grazes at night to make up the difference. Humidity and temperature are two important factors in Louisiana.

McCullough(Ga.): What if it is too wet to get in the field?

Answer: In such cases hay is fed.

Burton(Ga.): Would grazing be better in wet times than hay feeding?

Answer: The cow should get a fill regardless of weather conditions. Many dairies are already feeding other feeds.

McCullough: What about shifting rations when feed can't be reached?

Answer: I think a fill on some kind of feed is more important than a change in kind of feed, but our cows were already on grain feeding.

McCullough: We attempted this with beef steers last year but rains prevented feed collection most of the time.

Vegors(Ga.): Zero grazing may influence the internal parasite problem.

10:00 A.M. [✓] Possibilities of Dehydrating, Blending of Forage into Balanced Rations and Pelletting as a Means of Obtaining Better Utilization of Forage Crops Through Cattle -
J. F. Hentges, Jr., Fla.

The practice of dehydrating forage for pelletting with concentrates to make a balanced ration has been in practice for years. In the past, almost all of the dehydrated forage has been alfalfa and the major outlets for the pelleted dehydrated feeds has been to feeders of monogastric animals such as swine, rabbits, poultry and laboratory animals. The rations of these animals must be fortified with vitamin A, B vitamins,

minerals and proteins. Alfalfa pellets can be rich in carotenoids which may be converted into vitamin A in the body. In addition, alfalfa is a good source of several B vitamins, mineral elements, protein and unknown factors.

In recent years, increased tonnages of pelleted feeds have been fed to ruminants, particularly dairy cattle and calves. Research interest in the use of pelleted feeds for lambs and beef cattle has increased during the last three years. Preliminary experimental results are now available on the use of several forages in the formulation of pellets containing various ratios of roughage to concentrates for ruminant feeding.

For the purpose of creating interest in a discussion of future research efforts to maximize livestock gains on high forage rations, I have outlined a summary of the recent research results relative to this subject.

1. Lactating dairy cows have produced up to 25% more milk when 1.5 pounds of alfalfa pellets per 100 pounds live weight were fed in addition to a ration of U. S. No.2 timothy hay and concentrates.
2. Alfalfa pellets were shown to be an ideal source of carotene and forage for dairy calves. The calves ate most and grew fastest when alfalfa pellet feeding was limited to 18% of the starter ration initially and increased 1.2% each week.
3. The pelleting of lamb fattening rations containing 50 to 60% alfalfa has produced larger weight gains with less feed required per unit of gain. Because of the cost of pelleting, the practical aspect of pelleting appears to be the use of some low quality roughage in the self-fed lamb ration.
4. The pelleting of drylot steer fattening rations containing 20% alfalfa hay has produced larger weight gains with savings of as much as 227 pounds of feed per 100 pounds gain.
5. Dehydration of waste or surplus forages with a high moisture content (sugar beet tops, celery pulp, etc.) will permit storage for feeding to ruminants during periods of need.
6. The use of estrogenic materials to increase gains and efficiency of feed utilization by steers may focus more attention on the use of highly digestible forages in fattening rations since 50 species of plants (including Ladino clover, red clover, wheat, oats and rye) have been shown to possess estrogenic activity.
7. Reports that steer weight gains on highly digestible (65-77% TDN) temporary pastures can exceed drylot weight gains may create a need for pelleted pasture supplemental feeds containing hormones, antibiotics and nutrients needed to maintain an active rumen microflora. The feeding of diethylstilbestrol has been shown to increase pasture gains. The feeding of aureomycin and terramycin to steers has been greatest on high roughage rations. Small doses of penicillin has been shown to prevent bloat in steers on Ladino clover for 1.5 to 3.0 days.

8. Increased feeding value from low quality roughages has been realized by use of supplements containing dehydrated alfalfa meal and other ingredients.
9. The possibilities of green soiling for obtaining better utilization of forage crops through cattle has been shown. Soiling has produced a much greater yield of beef per acre than rotational grazing, strip grazing or haying.

General Approach:

- B. L. Southwell (Ga.): We need forages containing the following three qualities:
1. High milk production.
 2. Fattening beef animals.
 3. Maintenance in periods of low production.

For 1 and 2 we need about the same plants and crops. Characteristics needed in plants are: (a) High yield, (b) Rapid growth, and (c) Slow maturity. We need a system of crops for 365-day feeds rather than for only a few months.

E. N. Fergus (Ky.): Cost of the animal product involves:

- | | |
|----------------------------|------|
| 1. Management of livestock | 25% |
| 2. Feed | |
| a. Harvested | 37½% |
| b. Pasture | 37½% |

In general, costs will be reduced through the feed costs and the balance of costs are to fit each farm situation. The above are only relative breakdowns.

H. W. Bennett (Miss.): We are attempting a system of storage of the surplus to feed in times when pastures are in short supply. Life history studies combined with livestock practices and needs will give us the answer to this.

Thursday Morning, May 17

Section II. Forage Crop Breeding - Second Session

C. H. Hanson, N.C., Chairman
P. B. Gibson, S. C., Secretary.

8:00 A.M. ^x The Nematode Problem in the Southeast - Panel Discussion,
J. L. Allison and J. N. Sasser, N. C.

J. L. Allison: Root-knot nematodes, Meloidogyne spp., are destructive to a large number of host plants and are known to attack the following perennial forage legumes in North Carolina: alfalfa, red clover, white clover including Ladino, big and birdsfoot trefoil, and sericea lespedeza. Sixteen varieties and 5 accessions of alfalfa, 2 varieties each of red and white clover including Ladino, one variety each of big and birdsfoot trefoil and 5 accessions of sericea lespedeza were tested in both seedling and mature stages of growth to each of the following Meloidogyne spp., M. arenaria, M. hapla, M. incognita, M. incognita

acrita and M. javanica. Although plants of all legume genera were susceptible to each of the nematode species in both seedling and mature stages of growth, they differed in degree of susceptibility. The clovers and trefoils were uniformly very susceptible to all species. The alfalfas and sericea lespedezas were moderately susceptible to all species except M. hapla. To M. hapla the alfalfas were very susceptible but the sericea lespedezas were moderately resistant. Plants of a few alfalfa varieties and accessions were resistant to all the root-knot nematode species. There was greater variability in reaction in sericea lespedeza than in the other legume genera.

Stem nematodes, Ditylenchus spp., are destructive to alfalfa in several locations but have not been observed damaging other perennial legumes in North Carolina. Thirty-one varieties and accessions of alfalfa and 2 varieties each of red and white clover including Ladino, were tested in the seedling stage to 3 collections of alfalfa stem nematode obtained from widely separated areas of the state. Cotyledonary seedlings growing on moist blotting paper or in moist sand were inoculated by atomizing a suspension of nematodes onto them. Seedlings were kept moist and were incubated at 65° F. Initial symptoms appeared in 7 to 10 days and reaction readings were made 2 weeks following inoculation. Surviving seedlings were grown on to maturity. There were no differences in pathogenicity among the 3 collections. Differences in degree of susceptibility among the alfalfas and clovers were apparent. All alfalfas were more susceptible than the clovers. The stem nematode resistant alfalfa variety Lahonton and accessions derived from it exhibited only moderate resistance to the North Carolina collections.

J. N. Sasser: Plant parasitic nematodes probably cause greater crop losses in the Southeast than those caused by any other single group of microorganisms. All crop plants are affected as well as ornamentals and forest trees. All nematodes do not attack all crops but all crops are attacked by at least one and more often several parasitic forms. Those groups known to be causing considerable damage to southern pasture and forage crops include root knot (Meloidogyne spp.), meadow (Pratylenchus spp.), bulb and stem (Ditylenchus spp.), lance (Hoplolaimus spp.), stunt (Tylenchorhynchus spp.), sting (Belonolaimus spp.), stubby root (Trichodorus spp.), spiral (Helicotylenchus and Rotylenchus spp.), pin (Paratylenchus spp.), soybean cyst and clover cyst (Heterodera glycines and H. trifolii, resp.), grass nematodes (Anguina spp.) and undoubtedly others.

Some of the above species attack only the roots of plants while others attack the stems and leaves. Some even attack the seed. There are two broad categories of control. The first might be called exclusion, which is simply not permitting the nematode to come onto your property. The second method might be termed "learning to live with the nematode" once we have it. It is this latter category that the plant breeders, plant pathologists and nematologists and others are primarily concerned with. Control programs are carried out by one or a combination of the following methods: (1) sanitation, (2) crop rotation, (3) cultural practices, (4) soil fumigation and (5) breeding for resistance. It would appear that the most promising method for controlling nematodes in pasture and forage crops would be in breeding for resistance. Much progress has already been made in this field.

Viruses attack some of our most important forage crops in the southeastern United States. In some cases they kill plants outright, and in other cases weaken them so that they die under stress conditions. At present, two of our major virus disease problems concern forage legumes: (1) The production of sweet yellow lupine seed in the Southeast has been almost curtailed by the ravages of virus infection. (2) The growth and persistence of Ladino clover and white clover is greatly affected by virus infection. Damage from virus infection is illustrated by the reduction in yield obtained in virus infected Ladino clover. In greenhouse and field tests conducted at Beltsville, Maryland, virus-infection reduced yield in clonal plots of Ladino clover one-half. The virus problem in our forage legumes is particularly formidable because of the broad host range of the viruses concerned. In addition, we are frequently confronted with more than one virus attacking the plant simultaneously. Fortunately, most of the viruses with which we are dealing are mechanically transmissible; however, in order to find resistant plants, large populations have to be inoculated. This may require considerable time and space. The plants must be of suitable size or age when they are inoculated. Inoculum for infecting the plants artificially must be obtained from living plants, since viruses cannot be cultured artificially. This means maintaining a reservoir of inoculum that can be prepared in quantity. Some viruses require considerable time before symptoms are expressed. In other cases, the virus symptoms may be latent and the virus must then be sub-inoculated to a suitable test host to determine whether it was present in the host inoculated. Various techniques are now being utilized, such as inoculating plants at various ages to determine when the plant is most susceptible. Other techniques involve use of high-pressure equipment in which the virus is atomized on plants along with a suitable abrasive. In attempting to devise a rapid and simple technique for inoculating large numbers of Ladino clover seedlings with virus it was learned that earliest infection can be obtained by inoculating the cotyledons or the first simple leaf that appears. Symptoms usually develop in about 10-15 days. By this technique virus symptoms and confirmation of virus presence have been obtained on seedling Ladino clover plants 3 to 4 weeks following sowing of the seed in soil. This technique has shortened substantially the period required for screening plants.

10:00 A.M. * Recurrent Selection for Anthracnose Resistance in Red Clover Breeding - N. L. Taylor, Ky.

Recurrent selection was first proposed by Hull for corn breeding in 1944 and has been used to a limited extent in forage crops. Briefly, the process consists of outcrossing each of a group of desirable plants, at the same time inbreeding the same plants; then progeny testing, using the outcross seed and propagating the desirable plants, using the self seed. These plants are then intercrossed and the process repeated.

A modification of this procedure may be used in perennial crops and is being used in the red clover breeding program at the Kentucky Experiment Station. Inasmuch as most perennials may be maintained by clones, there is no necessity for inbreeding. The desirable clones are selected on the basis of the polycross progeny test. These desirable clones are divided into four or more groups and are intercrossed in isolation and the process is again repeated. Selections may be stopped at any time when sufficient progress has been made.

10:20 A.M. ^X Breeding Annual Ryegrass for Resistance to Crown Rust -
H. D. Wells, Ga. ⁷

The ryegrass breeding program at Tifton, Georgia, was initiated in the spring of 1953 by subjecting commercial Westerwold's ryegrass to artificial inoculation with crown rust (Puccinia coronata) in a fog chamber in the greenhouse. The original material showed only 0.4 percent resistance. By allowing only rust-free plants to interpollinate each year, the rust resistance has been increased to 76, 89, and 91 percent in successive years. No loss of vigor has occurred. It is anticipated that seed will be available for evaluation of this selection in ryegrass variety trials during the 1956-1957 ryegrass season.

The first item of business was the election of a new member to the Executive Committee. The Nominating Committee presented the name of Dr. Ethan Holt of Texas, as the new member. Dr. Holt was unanimously elected. Dr. Blaser announced the new chairman of the conference to be Dr. Wayne Huffine from Oklahoma.

The membership of the Executive Committee for the coming year is as follows:

	<u>Term expires</u>
D. S. Chamblee, N. Car.	1957
R. E. Blaser, Va.	1958
W. W. Huffine, Okla.	1959, Chairman
P. B. Gibson, S. Car.	1960
E. C. Holt, Tex.	1961
R. H. Lush, Tenn. (Dairy Husbandry)	
H. H. Leveck, Miss. (Animal ")	
P. R. Henson, Md. - Permanent secretary	

Dr. E. N. Fergus invited the group to Kentucky in 1957. In making the invitation, Dr. Fergus pointed out that a new dormitory would be available to the conferees after June 10, 1957. Dr. H. W. Bennett of Mississippi, invited the group to the Mississippi Station in 1957. The Secretary read an invitation to meet in South Carolina in 1958 from Dr. M. D. Farrar, the Director of the S. C. Agricultural Experiment Station.

It was moved by Dr. Wells, Ga., that the conferees accept the invitation from Kentucky to meet there in 1957. The motion was seconded and unanimously carried.

The Chairman opened the meeting to a discussion on the type of program to have in 1957. It was brought out that the Program Committee should cooperate informally with corresponding committees of S-12 to secure a program of a type desired by the majority. It was generally agreed that we should encourage more animal men to attend the conference. Dr. J. R. Harlan, Okla., Chairman of S-12, called attention to the meeting of S-12, beginning at 1:15 that afternoon in the upstairs conference room. He invited other project leaders not already on the S-12 Committee to attend this Forage Crops Conference.

Dr. Huffine moved that the secretary write a letter to the officials of the Georgia Experiment Station, expressing our gratitude for the excellent arrangements and facilities for holding the conference. This motion was seconded and passed unanimously.

Dr. Sell asked if members were planning to visit other Georgia Experiment Stations. Dr. Burton asked that those coming to Tifton meet Friday at 8:15 A.M. at the Experiment Station Office at Tifton. Dr. Sell discussed resolutions and pointed out to the members that specific resolutions dealing with phases of forage and pasture investigations are well worthwhile, particularly so to indicate future research needs.

Dr. Jeffers, West Florida Experiment Station, asked about the program of Section IV on physiology and environment. Dr. Chamblee, N. Car., reviewed this section and explained that his section on fertility covered only one phase of Section IV, as originally established. Next year temperature may be the main topic. Dr. Jeffers stated that more work and reports on physiology and ecology are desirable. The point was brought out that physiology had been covered in two previous conferences and that there was not enough new work to justify a full session on physiology alone.

Dr. Sell pointed out that the animal men in attendance had met the previous afternoon. From their discussion it was apparent that a joint session on forage evaluation, with the forage breeders as well as the management men, would be very desirable.

Dr. Blaser thanked the Program Chairmen for their excellent work and turned the meeting over to the new Chairman, Dr. Wayne Huffine, of Oklahoma.

The Conference adjourned at 11:40 A.M.

Registration List - 1956

<u>Name</u>	<u>Address</u>	<u>Affiliation</u>
Adams, W. E.	Athens, Ga.	University of Georgia
Allison, J. L.	Raleigh, N. Car.	N. C. Agric. Expt. Station
Anderson, O. E.	Experiment, Ga.	Ga. " " "
Anthony, W. B.	Auburn, Ala.	Ala. " " "
Appling, E. D.	Blairsville, Ga.	Ga. Mountain " "
Baird, D. M.	Experiment, Ga.	" Agric. Expt. Station
Bashaw, E. C.	College Station, Tex.	Tex. " " "
Bates, R. P.	Ardmore, Okla.	Samuel Roberts Noble Found.
Baxter, L. W.	Clemson, S. Car.	Botany Dept., Clemson College
Beaty, E. R.	Athens, Ga.	Univ. of Georgia
Belasco, I. J.	Wilmington, Del.	Du Pont de Nemours Company
Bennett, H. W.	State College, Miss.	Miss. Agric. Expt. Station
Blaser, R. E.	Blacksburg, Va.	Va. " " "
Boswell, Fred	Experiment, Ga.	Ga. " " "
Brown, W. V.	College Station, Tex.	Dept. of Botany, Univ. of Tex.
Burns, J. D.	Atlanta, Ga.	Lion Oil Company
Burns, R. E.	Experiment, Ga.	Ga. Agric. Expt. Station
Burton, G. W.	Tifton, Ga.	Coastal Plain " "
Carlson, Irving	Raleigh, N. Car.	N. Car. State College
Carter, R. C.	Blacksburg, Va.	Va. Agric. Expt. Station
Chamblee, D. S.	Raleigh, N. Car.	N. Car. State College
Chessmore, R. A.	Ardmore, Okla.	Samuel Roberts Noble Found.
Cope, W. A.	Raleigh, N. Car.	N. Car. Agric. Expt. Station.
Craigsmiles, J. P.	Experiment, Ga.	Ga. " " "
Cullison, A. E.	Athens, Ga.	Univ. of Georgia

Registration List (Cont.)

<u>Name</u>	<u>Address</u>	<u>Affiliation</u>
Dalton, H. L.	Athens, Ga.	University of Ga.
Daniels, Eston	Tifton, Ga.	Coastal Plain Expt. Station
Davis, A. M.	Fayetteville, Ark.	Ark. Agric. Expt. Station
Donker, J. D.	Athens, Ga.	University of Ga.
Donnelly, E. D.	Auburn, Ala.	Ala. Agric. Expt. Station
Earhart, R. W.	Clemson, S. Car.	S. Car. " " "
Ellzey, H. D.	Franklinton, La.	S. E. La. Agric. Expt. Station
Elrod, J. M.	Experiment, Ga.	Ga. Agric. Expt. Station
Engel, R. W.	Blacksburg, Va.	Va. " " "
Evans, E. M.	Auburn, Ala.	Ala. " " "
Fergus, E. N.	Lexington, Ky.	Ky. " " "
Forbes, Ian, Jr.	Tifton, Ga.	Coastal Plain " "
Futral, J. G.	Experiment, Ga.	Ga. Agric. " "
Gallun, R. L.	Lafayette, Ind.	Ent. Dept., Purdue Univ.
Gibson, P. B.	Clemson, S. Car.	S. C. Agric. Expt. Station
Gill, John	Raymond, Miss.	Brown Loam " "
Gore, U. R.	Experiment, Ga.	Ga. Agric. " "
Graf, G. C.	Blacksburg, Va.	Va. " " "
Graumann, H. O.	Beltsville, Md.	Field Crops Res. Br., ARS
Grimes, H. W. Jr.	Auburn, Ala.	Ala. Agric. Expt. Station
Gross, H. D.	Raleigh, N. Car.	N. C. " " "
Gurley, W. H.	Athens, Ga.	Ga. Agric. Extension Service
Hanson, A. A.	Beltsville, Md.	Field Crops Res. Br., ARS
Hanson, C. H.	Raleigh, N. Car.	N. C. Agric. Expt. Station
Hardison, W. A.	Blacksburg, Va.	Va. " " "
Harlan, J. R.	Stillwater, Okla.	Okla. " " "
Hauser, E. W.	Experiment, Ga.	Ga. " " "
Hawkins, G. E.	Auburn, Ala.	Ala. " " "
Henderson, H. B.	Athens, Ga.	University of Ga.
Hendrickson, B. H.	Watkinsville, Ga.	Piedmont Expt. Station
Henson, P. R.	Beltsville, Md.	Field Crops Res. Br., ARS
Hentges, J. F. Jr.	Gainesville, Fla.	Fla. Agric. Expt. Station
Hick, R. D.	Auburn, Ala.	Ala. " " "
Hodges, Elver	Ona, Fla.	Range Cattle Station
Hollowell, E. A.	Beltsville, Md.	Field Crops Res. Br., ARS
Holt, E. C.	College Station, Tex.	Tex. Agric. Expt. Station
Huffine, W. W.	Stillwater, Okla.	Okla. " " "
Hughes, R. H.	Tifton, Ga.	U. S. Forest Service
Hunt, O. J.	Beltsville, Md.	Field Crops Res. Br., ARS
Jacks, J. F.	Osceola, Ark.	Alfalfa Substation
Jackson, J. E.	Tifton, Ga.	Coastal Plain Expt. Station
Jeffers, R. L.	Jay, Fla.	West Florida " "
Johnson, Corwin	State College, Miss.	Miss. Agric. " "
Jones, D. W.	Ona, Fla.	Range Cattle " "
Kincaid, C. M.	Knoxville, Tenn.	Tenn. Agric. " "
King, G. H.	Athens, Ga.	College of Agric.
King, K. W.	Blacksburg, Va.	Va. Agric. Expt. Station
Kreitlow, K. W.	Beltsville, Md.	Field Crops Res. Br., ARS

Registration List (Cont.)

<u>Name</u>	<u>Address</u>	<u>Affiliation</u>
Langford, W. R.	Auburn, Ala.	Ala. Agric. Expt. Station
Lewis, R. D.	College Station, Tex.	Tex. " " "
McCaleb, J. E.	Ona, Fla.	Range Cattle " "
McCloud, D. E.	Gainesville, Fla.	Fla. Agric. Expt. Station
McCullough, M. E.	Experiment, Ga.	Ga. " " "
McMillen, R. W.	Raleigh, N. Car.	N. C. " " "
Mames, T. C.	Spartanburg, S. Car.	Soil Conservation Service
Massey, J. H.	Experiment, Ga.	Ga. Agric. Expt. Station
Miller, W. J.	Athens, Ga.	University of Ga.
Moore, W. E. C.	Blacksburg, Va.	Va. Agric. Expt. Station
Morcock, J. C.	Atlanta, Ga.	Allied Chemical & Dye Corp.
Nash, J. N.	Decatur, Ga.	Soil Conservation Service
Neathery, M. W.	Blairsville, Ga.	Ga. Mountain Expt. Station
Newton, J. P.	Experiment, Ga.	Ga. Agric. " "
Owen, C. R.	Baton Rouge, La.	La. " " "
Park, J. K.	Clemson, S. C.	S. C. " " "
Parker, E. M.	Atlanta, Ga.	Spencer Chemical Co.
Patterson, R. M.	Auburn, Ala.	Ala. Agric. Expt. Station
Perkins, H. F.	Athens, Ga.	University of Georgia
Pierce, H. H.	Lexington, Ky.	Ky. Agric. Expt. Station
Powell, J. D.	Americus, Ga.	Ga. Branch " "
Reed, J. F.	Atlanta, Ga.	American Potash Inst.
Rennie, W. W.	Wilmington, Del.	DuPont Company
Rivera-Brenes, L.	Rio Piedras, P. R.	Puerto Rico Expt. Station
Rogers, T. H.	Athens, Ga.	University of Ga.
Rollins, Gilbert	Auburn, Ala.	Ala. Agric. Expt. Station
Sasser, J. N.	Raleigh, N. C.	N. C. " " "
Schultz, Fred	Auburn, Ala.	Ala. " " "
Sell, O. E.	Experiment, Ga.	Ga. " " "
Shelley, R. C.	Clemson, S. C.	S. C. " " "
Shoulders, J. F.	Blacksburg, Va.	Va. " " "
Simons, Henry	Atlanta, Ga.	Farm Journal Magazine
Smart, W. W. Jr.	Raleigh, N. Car.	N. C. Agric. Expt. Station
Southwell, B. L.	Tifton, Ga.	Coastal Plain Expt. Station
Stacy, S. V.	Experiment, Ga.	Ga. Agric. " "
Starling, Jim	Headland, Ala.	Wiregrass " "
Staten, R. D.	College Station, Tex.	Tex. Agric. " "
Stewart, E. H.	Clemson, S. Car.	S. C. " " "
Stone, E. J.	Baton Rouge, Ala.	La. " " "
Tabor, Paul	Athens, Ga.	Soil Conservation Service
Taylor, L. H.	Blacksburg, Va.	Va. Agric. Expt. Station
Taylor, N. L.	Lexington, Ky.	Ky. " " "
Taylor, T. H.	" "	" " " "
Tippins, H. H.	Experiment, Ga.	Ga. " " "
Velez-Fortuno, J.	Rio Piedras, P. R.	Puerto Rico " "
Warwick, Everett	Beltsville, Md.	Cattle Research Section, ARS
Webb, B. K.	Clemson, S. Car.	S. C. Agric. Expt. Station
Weihing, R. M.	Beaumont, Tex.	Rice-Pasture Expt. "
Welch, C. D.	Raleigh, N. Car.	N. C. Agric. " "
Wells, H. D.	Tifton, Ga.	Coastal Plain " "
Woodhouse, W. W.	Raleigh, N. Car.	N. C. Agric. " "

